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ABSTRACT

The National Science Foundation (NSF) provides awards for education and research in the sciences, mathematics, and engineering. This publication contains information about awards for the 1987 and 1988 fiscal years. An introductory section reviews the goals of NSF's education program and the long-range goals of the Directorate for Science and Engineering Education. Data on fiscal appropriations are provided and the directorate staff and advisory committee are identified. An index lists the awards alphabetically by state and specifies the institution, project director, and discipline addressed. Information on each award includes: (1) project director's name; (2) institution; (3) award number; (4) award amount; (5) time duration; (6) discipline area; and (7) project title and abstract. Appendices contain lists of graduate fellowship awards, minority graduate fellowship awards and postdoctoral fellowship awards from the North Atlantic Treaty Organization (NATO). (MVL)

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ED309026

DIRECTORY OF AWARDS

FISCAL YEARS 1987 AND 1988

SE 050 639

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Directorate for Science and
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NATIONAL SCIENCE FOUNDATION

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Other Publications of Interest :

Program Announcements and Guidelines:

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Division of Teacher Preparation and Enhancement	NSF 87-10
Division of Research Career Development:	
Graduate Fellowships	NSF 88-57
Minority Graduate Fellowships	NSF 88-58
NATO Postdoctoral Fellowships in Science and Engineering	NSF 88-67
Presidential Young Investigator Awards	NSF 88-34
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Office of Studies and Program Assessment	NSF 88-69
Office of Undergraduate Science, Engineering, and Mathematics Education :	
Instrumentation and Laboratory Improvement	NSF 88-90
Career Access Opportunities in Science and Technology	NSF 88-102
Undergraduate Faculty Enhancement Program	NSF 88-33
Undergraduate Curriculum Development in Mathematics (Calculus)	NSF 88-83
Undergraduate Curriculum Development in Engineering	NSF 88-84
Research Experiences for Undergraduates	NSF 88-28

FOREWORD

Three years ago, the National Science Foundation Directorate for Science and Engineering Education (SEE), published the first in a series of documents listing and summarizing awards to individuals and institutions participating in a national effort to improve the quality of education in science, mathematics, and engineering at all levels from the elementary grades through graduate school. It is a physical measure of progress that the current volume is more than twice the size of that first one and substantially larger than the second, which was published two years ago. This progress coincides with a renaissance of SEE that began in earnest less than five years ago. In that brief period, new obligations for Science and Engineering Education have more than trebled, from $54.4 million in fiscal 1984 to $171 million in the present fiscal year.

Physical size of documents and magnitude of appropriations are only the roughest measures of a program's accomplishments. It takes more subtle evaluation to assess true progress in any effort of this nature. The questions to be asked and answered are: What urgent national need is being addressed by the program in question? What steps are being taken to meet this need, and with what degree of success is it being met?

The urgent national need we seek to fulfill is not just ensuring an adequate supply of scientists, engineers and technologists to maintain American eminence in an increasingly science-oriented world, but also the education of a literate society, which pays for, and in the end enjoys, the fruits of discovery and progress. Scientific literacy -- a reasonably broad understanding of scientific concepts and mathematical laws -- is as much a part of true literacy in today's world as the ability to read and write.

In reviewing the progress chronicled in the pages that follow, I am especially pleased that many projects targeted at pre-high school education are well under way. This is a bold venture, and a relatively new one. It recognizes the need to "catch 'em young", to interest students at an early age in the wonder and challenge of science, and to keep that interest alive through elementary, middle, and high school years, and on into college. About half of the funding for this pre-college effort goes for high school programs, and about half for those in lower grades.

In response to recommendations made by the National Science Board in a 1986 Report on Undergraduate Science, Mathematics and Engineering Education, SEE has "expand[ed] and establish[ed] programs which assist the restoration of academic health to undergraduate education in the fields within the domain assigned to it." In three years time, the funding has grown (in current year dollars) from $5.3 million to $28 million for instrumentation and laboratory improvement, faculty enhancement, curriculum development, and career access opportunities for underrepresented groups. This growth in SEE's instruction-related activities has been exceeded by an even larger increase in funding of the research-related undergraduate programs distributed among the NSF's research directorates. The research-related undergraduate programs are not included in this publication.

Given continuity of purpose through the final decade of this century, the American educational establishment can begin to close a brainpower gap between needs and resources that, left unattended, would result in a shortfall of some 450,000 bachelor of science degree holders by the year 2000. Current efforts cannot completely close the gap in that time frame; too few years remain to accomplish that daunting task. But it can be -- it is -- a beginning that must be brought to completion.

Bassam Z. Shakhashiri

Bassam Z. Shakhashiri

Assistant Director for
Science and Engineering Education

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INTRODUCTION

In the National Science Foundation Act of 1950 (42 U.S.C. Sec. 1862, as amended) Congress authorizes and directs the Foundation "to initiate and support.....science education programs at all levels in the mathematical, physical, medical, biological, social, and other sciences.....and engineering education programs at all levels in the various fields of engineering." Since its inception the Foundation has funded a wide variety of projects designed to enhance the quality and effectiveness of such education in schools, colleges, and universities.

Overall, the goals of NSF's education activities are to stimulate and lead nationwide efforts that will strengthen and accelerate the transmission, adaptation, and utilization of knowledge from the engineering, mathematical, and scientific disciplines; that will attract talented youth to careers in those fields and prepare them for sustained creative endeavor; and that will provide to students of every age and persuasion such background in the disciplines as will sustain their understanding and use of mathematics and science. Those goals encompass all levels of education and all stages of human resources development.

At every educational level, the Government's role is to provide incentives; help to establish models; and foster coherence, exchange of information, the pursuit of quality and equal opportunity, and the appreciation and understanding of national needs. In the areas of science, mathematics and engineering education, the National Science Foundation is the main actor; its responsibility is to provide national leadership in education that is consistent with its general mission: to strengthen scientific research potential and science education at all levels.

Education occupies a prominent position in the NSF legislative mandate and has been an important Foundation activity for over 30 years. Over this period, the National Science Foundation has helped set high standards of quality for the preparation of future scientists and engineers. NSF-supported projects have provided exemplary tools and techniques that have been adopted and adapted widely in this country and abroad. Now, the growing worldwide importance of science and technology requires that the Foundation greatly expand upon its traditional pattern of concern for preprofessional and professional education to consider the needs of the vast majority of students--those who comprise tomorrow's citizenry at large.

The Foundation is concerned for the quality and effectiveness of the mathematics and science instruction received by all students. It designs broadly unified educational programming to meet the needs of the school population at the lowest educational levels, and those of the citizenry at large. As talent for science and mathematics begins to appear, and as students make increasingly strong self-identifications with and, later, commitments to careers in technical fields, NSF's programming changes to reflect the resulting steadily increasing and sharpening diversity.

The Foundation will consider proposals for support of educational activities in any field of science, including but not necessarily limited to: astronomy, atmospheric sciences, biological sciences, behavioral sciences, chemistry, computer sciences, earth sciences, engineering, information science, mathematical sciences, materials science, oceanography, physics, and the social sciences. Interdisciplinary and multidisciplinary proposals also are eligible for consideration.

Because education is the responsibility of many institutions, the Foundation seeks to play a catalytic role that will enhance local efforts, bring to bear the skills and knowledge of the Nation's best scientists and educators, and engage the resources of both the public and private sectors. The Directorate for Science and Engineering Education (SEE) defines and funds programs and projects that support this educational mission.

DIRECTORATE
for
SCIENCE AND ENGINEERING EDUCATION

The Directorate for Science and Engineering Education (SEE) is budgeted separately within the National Science Foundation as the primary focus for education programming. SEE bears principal responsibility for implementation of the leadership and support roles played by the Foundation in science, mathematics, and engineering education, and is thus a principal trustee of the Foundation's education agenda.

SEE's Division of Teacher Preparation and Enhancement (DTPE) and Division of Materials Development, Research, and Informal Science Education (MDRISE) are responsible for precollege activities. The Division of Undergraduate Science, Engineering, and Mathematics Education (USEME) coordinates the education activities found in the research directorates and manages other undergraduate education programs of its own. SEE's Division of Research Career Development (DRCD) manages programs at the graduate and postdoctoral levels, as well as programs designed to reach science-interested advanced precollege students. The Office of Studies and Program Assessment (OSPA) serves all units engaged in educational programming by supporting data collection, and analytic and evaluative studies of science, mathematics, technology, and engineering education at all levels.

The Directorate for Science and Engineering Education [SEE] has five major long-range goals. Each of these goals gives rise to a number of objectives for the Directorate's education activities; and, in turn, each of the Directorate's programs addresses one or more of these goals through subsets of those objectives. SEE's long-range goals are:

- To help ensure that a high quality precollege education in science and mathematics is available to every child in the United States.
- To help ensure that those who select scientific and engineering careers have available the best possible professional education in their discipline.
- To help ensure that the educational pipelines carrying students to careers in science, mathematics, and engineering yield sufficient numbers of well-educated individuals to meet the needs of the U. S. technical workforce.
- To help ensure that opportunities are available at the college level for interested nonspecialists to broaden their science backgrounds.
- To support informal science education programs to maintain public interest in, and awareness of, scientific and technological developments.

Superimposed on these five goals are two major concerns:

> To increase the representation of women, minorities and persons with disabilities in both the study and the professional practice of science, mathematics, and engineering. Special efforts will be made to insure full participation of members of underrepresented groups in all SEE operations, programs, and activities.
>
> To promote actively the inclusion of the private sector as partners in projects to improve science, mathematics, and engineering education.

NSF EDUCATION PROJECTS: GENERAL CONSIDERATIONS

The Foundation has unique familiarity and a special relationship with the science, mathematics, and engineering research and education communities in the Nation's laboratories, colleges, and universities, and is especially interested in fostering the involvement of members of those communities in the design and implementation of innovative education projects.

The NSF encourages partnerships in the projects it supports, including cooperative involvements among colleges and universities, local and state education agencies, cultural and professional institutions and societies, and business and industry. Such partnerships should be based on mutual interests and purposes, with all partners sharing not only in financing, but in development, implementation, and follow-up activities growing out of the collaboration.

The Foundation seeks leveraged application of its resources and is strongly committed to the principle of cost sharing in its projects, both as evidence of importance to the proposing institution, and as an indication of continuing commitment and long term impact. Cost sharing by collaborating partners is required in some programs and strongly encouraged in all others -- especially when the goals include continuation and maintenance of project activities by local institutions or self-sustaining networks after NSF funding terminates. Since it takes substantial time to develop meaningful collaboration, projects that have small initial contributions from such partnerships, but present a well-developed plan to organize them and phase out the NSF share of project costs, are encouraged also.

The National Science Foundation is strongly concerned about the underrepresentation of women, minorities and those with disabilities in careers in mathematics, engineering, and the sciences. Projects involving members of these groups as principal investigators or staff, or as the target audience, are especially encouraged. NSF is particularly interested in projects designed to test new approaches to increasing the numbers of students in such groups who are motivated to prepare themselves for careers in mathematics, science and engineering.

TABLE I

Expenditure by Unit for Fiscal Year 1983 - 1989
Directorate for Science and Engineering Education
($ in thousands)

	1983	1984	1985	1986	1987	1988	1989 PLAN
Materials Development, Research and Informal Science Education.....	$160	$18,422	$22,719	$24,356	$29,480	$37,499	$44,000
Teacher Preparation and Enhancement.......	$1,045	$13,873	$25,159	$26,256	$30,493	$45,438	$63,500
Studies and Program Assessment............	--	$1,809	$1,761	$2,785	$2,199	$3,235	$4,500
Undergraduate Science, Eng.[a] and Math Education....	--	--	$4,996	$5,259	$9,500	$18,999	$28,000
Research Career Development...........	$14,978	$20,322	$27,298	$25,938	$27,267	$33,985	$31,000
Total	$16,183	$54,426	$81,934	$84,595	$98,939	$139,156	$171,000

a) In fiscal years 1985 through 1987, this was the Office of College Science Instrumentation
In 1988, $11.5M of the $19M budget is a continuation of the OCSI program
$ 7.5M of the $19M budget is applied to new undergraduate programs

TABLE II

Directorate for Science and Engineering Education

Appropriations by Program Type and Fiscal Year

(Dollars in Millions)

	1983	1984	1985	1986	1987	1988	1989
Graduate Fellowships...	15.0	20.3	27.3	26.1	27.3	30.3	24.0
Undergraduate Science, Engineering and Math Education............	--	--	5.0	5.3	9.5	19.0	28.0
Secondary and Elementary Science and Mathematics Education............	15.0[a]	54.7[b]	49.7	53.2[c]	62.2	89.9	119.0
Total...............	30.0	75.0	82.0	84.6	99.0	139.2	171.0

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a) 13.9 carried over to fiscal year 1984
b) 31.5 carried over to fiscal year 1985
c) 31.5 deferred from fiscal year 1985
plus 21.7 new obligational authority

TABLE III

Directorate for Science and Engineering Education

Activity by Unit, 1983

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Materials Development, Research and Informal Science Education.......	109	3	$ 63,546	$160
Teacher Preparation and Enhancement.........	162	107[b]	$ 12,983	$1,044
Studies and Program Assessment..............	--	--	--	--
Undergraduate Science, Eng., and Math Education......	--	--	--	--
Research Career Development.............	3,830	1,390	N/A	$14,978

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a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

TABLE IV

Directorate for Science and Engineering Education

Activity by Level of Education, 1983

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Graduate Fellowships......	3,830	1,390	N/A	$ 14,978
Undergraduate Science, Engineering and Math Education...............	--	--	---	--
Secondary and Elementary Science and Mathematics Education...............	271	110[b]	$ 76.529	$ 1,204
Total	4.101	1.500	$ 76.529	$ 16.182

---

a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

TABLE V

Directorate for Science and Engineering Education

Activity by Unit, 1984

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Materials Development, Research and Informal Science Education.......	274	45	$103,939	$18,421
Teacher Preparation and Enhancement.........	597	214[b]	$145,891	$13,873
Studies and Program Assessment.............	29	15	$ 5,489	$ 1,809
Undergraduate Science, Eng. and Math Education......	--	--	--	--
Research Career Development............	4,449	1,510	N/A	$20,322

---

a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

TABLE VI

Directorate for Science and Engineering Education

Activity by Level of Education, 1984

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Graduate Fellowships......	4,449	1,510	N/A	$ 20,322
Undergraduate Science, Engineering and Math Education..............	--	--	---	--
Secondary and Elementary Science and Mathematics Education..............	900	274[b]	$255,319	$ 34,103
Total	5,349	1,784	$255,319	$ 54,425

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a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

TABLE VII

Directorate for Science and Engineering Education

Activity by Unit, 1985

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Materials Development, Research and Informal Science Education.......	486	95	$126,888	$22,091
Teacher Preparation and Enhancement.........	623	264[b]	$267,765	$25,015
Studies and Program Assessment..............	24	13	$ 5,864	$ 1,748
Undergraduate Science, Eng.[c] and Math Education......	1,348	234	$ 37,566	$ 4,836
Research Career Development.............	5,002	1,560	N/A	$27,298

---

a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.
c) Operated as "College Science Instrumentation" in 1985.

TABLE VIII

Directorate for Science and Engineering Education

Activity by Level of Education, 1985

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Graduate Fellowships......	5,002	1,560	N/A	$ 27,298
Undergraduate Science, Engineering and Math Education...............	1,348	234	$ 37,566	$ 4,836
Secondary and Elementary Science and Mathematics Education..............	1,133	372[b]	$400,517	$ 48,854
Total	7,483	2,166	$438,083	$ 80,988

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a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

TABLE IX

Directorate for Science and Engineering Education

Activity by Unit, 1986

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Materials Development, Research and Informal Science Education.......	346	111	$284,058	$24,356
Teacher Preparation and Enhancement.........	668	262[b]	$361,103	$26,256
Studies and Program Assessment.............	24	12	$ 5,456	$ 2,785
Undergraduate Science, Eng.[c] and Math Education......	924	211	$ 23,384	$ 5,259
Research Career Development.............	5,554	1,637	N/A	$25,938

---

a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.
c) Operated as "College Science Instrumentation" in 1986

TABLE X

Directorate for Science and Engineering Education

Activity by Level of Education, 1986

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Graduate Fellowships......	5,554	1,637	N/A	$ 25,938
Undergraduate Science, Engineering and Math Education...............	924	211	$ 23,384	$ 5,259
Secondary and Elementary Science and Mathematics Education..............	1,038	385[b]	$650,617	$ 53,397
Total	7,516	2,233	$674,001	$ 84,594

---

a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

TABLE XI

Directorate for Science and Engineering Education

Activity by Unit, 1987

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Materials Development, Research and Informal Science Education.......	301	152	$158,944	$29,480
Teacher Preparation and Enhancement.........	572	286[b]	$177,077	$30,493
Studies and Program Assessment..............	40	23	$ 9,663	$ 2,199
Undergraduate Science, Eng.[c] and Math Education......	982	347	$ 27,182	$ 9,500
Research Career Development.............	6,500	1,568	N/A	$27,267

---

a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.
c) Operated as "College Science Instrumentation" in 1987.

TABLE XII

Directorate for Science and Engineering Education

Activity by Level of Education, 1987

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Graduate Fellowships......	6,500	1,568	N/A	$ 27,267
Undergraduate Science, Engineering and Math Education...............	982	347	$ 27,182	$ 9,500
Secondary and Elementary Science and Mathematics Education..............	913	461[b]	$345,684	$ 62,172
Total	8,395	2,376	$372,866	$ 98,939

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a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

TABLE XIII

Directorate for Science and Engineering Education

Activity by Unit, 1988

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Materials Development, Research and Informal Science Education.......	378	149	$186,316	$37,811
Teacher Preparation and Enhancement.........	641	340[b]	$257,823	$45,532
Studies and Program Assessment..............	41	25	$ 11,547	$ 3,240
Undergraduate Science, Eng, and Math Education......	1,845	469	$219,769	$19,026
Research Career Development.............	6,448	1,751	$142,361	$34,021

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a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

TABLE XIV

Directorate for Science and Engineering Education

Activity by Level of Education, 1988

	Proposals Received	No. of Awards	Amount Requested[a]	Amt. of Awards[a]
Graduate Fellowships......	5,888	1,673	$107,689	$ 30,395
Undergraduate Science, Engineering and Math Education...............	1,845	469	$219,769	$ 19,026
Secondary and Elementary Science and Mathematics Education..............	1,620	592[b]	$490,357	$ 90,208
Total	9,353	2,734	$817,815	$139,629

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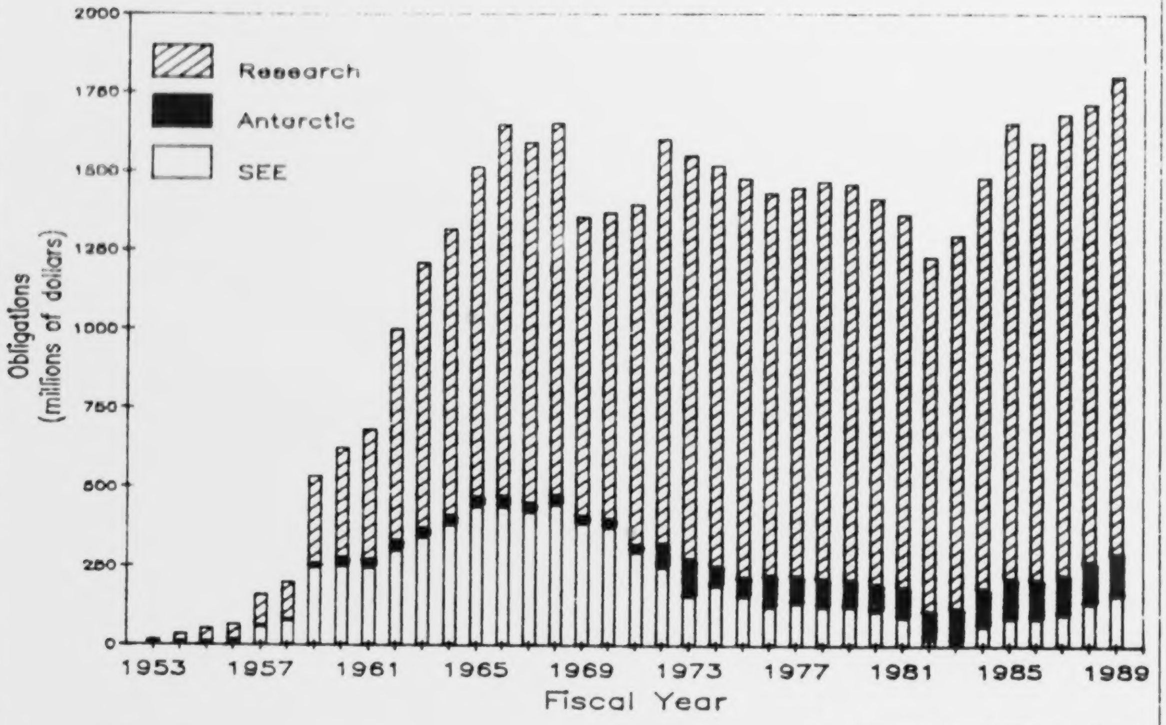
a) In thousands of dollars.
b) Includes Presidential Awards for Excellence in Science and Mathematics Teaching.

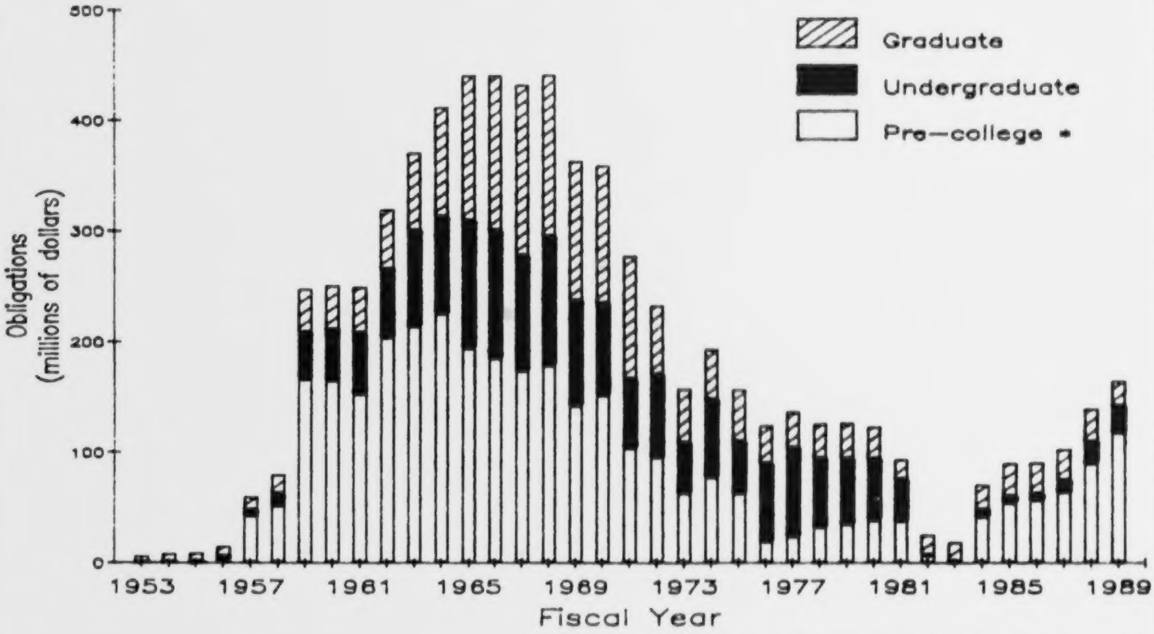
NSF OBLIGATIONS



In constant FY88 dollars

SCIENCE and ENGINEERING EDUCATION

Obligations by Level of Education
(in constant FY88 dollars)



* Includes Informal Science Education

CHART I

Current Organization and Budget of the Directorate for SEE

		FY89 BUDGET[a]
o Division of Materials Development, Research and Informal Science Education		$ 44,000
Applications of Advanced Technologies Program	$ 6,000	
Informal Science Education Program	15,000	
Instructional Materials Development Program	18,500	
Research in Teaching and Learning Program	4,500	
o Division of Teacher Preparation and Enhancement		$ 63,500
Science and Mathematics Education Network Program	$ 9,000	
Teacher Enhancement Program	43,200	
Presidential Awards for Excellence in Science and Mathematics Teaching Program	1,830	
Teacher Preparation Program	9,470	
o Office of Studies and Program Assessment		$ 4,500
Studies and Analyses Program	$ 4,500	
o Division of Undergraduate Science, Engineering, and Mathematics Education		$ 28,000
College Science Instrumentation Program	$ 16,000	
Faculty Enhancement Program	3,000	
Career Access Opportunities Program	5,000	
Course and Curriculum Program	4,000	
o Division of Research Career Development		$ 31,000
Graduate Fellowships Program	$ 21,600	
Minority Graduate Fellowships Program	2,400	
Young Scholars Program	7,000	

a) In thousands of dollars

DIVISION OF MATERIALS DEVELOPMENT, RESEARCH AND INFORMAL SCIENCE EDUCATION (MDRISE)

MDRISE comprises the following programs: Instructional Materials Development, Applications of Advanced Technologies, Research in Teaching and Learning, and Informal Science Education.

SEE's goals in the several programming areas of the MDRISE Division relate to a broad spectrum of concerns in science and mathematics education, especially at the precollege level.
They are:

- To support the development of prototypical instructional materials that can set standards and yet be practical models for improved instruction;
- To encourage exploration, development, and proof-of-concept demonstration of the application to education of advanced telecommunication and computer technologies;
- To catalyze the utilization of new materials and advanced technologies in diverse school systems;
- To expand our basic knowledge about the processes of teaching and learning; and
- To assure a balanced and rich environment of opportunities for informal learning through broadcast media, museums, and other activities.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

This program will provide support for projects in three principal areas: Large, integrated curriculum development projects; student and teacher support materials for single-discipline courses; and proof-of-concept demonstrations in major school systems. The major objectives are: to increase the span, consistency, and coherence of well-integrated K-12 curriculum materials available to school districts; to assure the availability of high quality single-discipline instructional materials reflecting recent scientific and pedagogical research; and to catalyze experimentation with and adoption of excellent new curriculum materials.

The program seeks an optimal balance between exploration and creation of prototypical materials that can set standards and models of how mathematics and science might be taught in the best of circumstances; and practical development that offers substantial impact and improvement in real-world schools and systems.

The highest priority of the program is development of new, alternative basic curricula in mathematics and science. The Foundation invites proposals for:

- Major integrated-curriculum projects spanning the elementary, middle, and high school years -- to yield new instructional materials that will: promote the mathematics and science literacy of students at all grade levels; build a sound background for disciplinary learning in both high school and college; and, provide an integrated, comprehensive preparation for later studies at the college level. Emphases will be placed on: engaging and impacting female, minority, and disabled students; early introduction of science; prevention of science/math aversion; and the acquisition of problem-solving skills.
- Projects that will generate single-discipline course materials, particularly for the secondary grades, and teacher support materials for science and mathematics instruction at all grade levels.
- Efforts to establish a more comprehensive and demanding K-12 mathematics curriculum-- especially those that would change the present heavily redundant emphasis on simple arithmetic.
- New efforts to establish alternative approaches to basic mathematics will direct the focus of instruction toward quantitative skills and insights that contribute to the problem-solving orientation appropriate to contemporary uses of mathematics.

RESEARCH IN TEACHING AND LEARNING PROGRAM

This program will support basic and applied research on the most significant factors believed to underlie effective teaching and learning at all levels. The focus will be strongly on the classroom. Emphasis is placed on: participation and achievement in science and mathematics, particularly of women and minorities; disciplinary-specific teaching and learning; curriculum content and sequence, including research on first-hand observation and the laboratory experience; and teacher knowledge and certification.

It is widely agreed that there is need to expand our basic knowledge about the processes of teaching and learning mathematics, technology, and the sciences, and about the factors that are most influential in determining success in these fields. NSF is responsive to this need primarily through the Research in Teaching and Learning Program. Projects supported by SEE assist advancement of the quality of education by being related directly to educational processes; they are usually collaborative efforts involving experts in subject matter fields, science education, and the cognitive and social sciences.

A major concern of the Program is exploration of the factors that influence: student participation and achievement in science and mathematics; stimulation of student interest and cultivation of talent; development of motivation and curiosity; and the making of curricular and career choices (and persistence in them).

INFORMAL SCIENCE EDUCATION PROGRAM

The Informal Science Education Program will continue its efforts to assure a balanced and rich environment that encourages informal learning across a broad range of interests, age and sophistication. Principal efforts focus in the areas of broadcasting, museums, and science-related community activities. All aspects of the Program are designed to stimulate and maintain self-confident interest in science, mathematics, and technology. Emphases are placed on broadening the audience, experimenting with new techniques for information distribution, reaching smaller institutions, and facilitating partnerships and interactions with schools.

APPLICATIONS OF ADVANCED TECHNOLOGIES PROGRAM

This Program is responsible for the support of research, development, and demonstration of the application of state-of-the-art telecommunications and computer technologies to science, mathematics, and engineering education. Changes in technologies are so rapid that the Program deals only with issues at the forefront of their application; its method is to support innovative projects that will lay the research and conceptual foundation for new technologies that will be available in the near future (five to ten years). Particular emphasis is placed on: knowledge-based systems and intelligent tutors; new computational tools and symbol manipulation systems; and proof-of-concept and "critical mass" demonstrations.

DIVISION OF TEACHER PREPARATION AND ENHANCEMENT

The Division of Teacher Preparation and Enhancement (DTPE) comprises the following Programs: Teacher Enhancement (for active teachers), Teacher Preparation (for those studying for the profession), Science and Mathematics Education Networks (among active teachers), and Presidential Awards for Excellence in Science and Mathematics Teaching. The Directorate's goals in this domain are:

- To improve the subject-matter competence and pedagogical skills of the Nation's science and mathematics teachers at the elementary, middle, and secondary levels;
- To develop examples and prototypes of successful preservice and inservice teacher education programs that can be adapted and adopted by teacher preparation institutions and school districts throughout the Nation;

- To disseminate the materials and methods developed in NSF-funded projects and other information likely to enhance the quality of science teaching;

- To identify, recognize, and reward excellence in teaching, and to assist teacher/leaders to share their expertise with colleagues; and

- To encourage and promote communications and collaboration of a wide range of individuals involved in science education: teachers, educational administrators, college and university professors, and research scientists in the public, private, profit, and non-profit sectors.

In attempting to achieve these goals, the Foundation has a dual strategy. It seeks to support well-designed projects that will directly benefit the teacher/participants by making them more competent in the subject matter, more comfortable in its presentation, and more committed to their profession and their pupils. Such anticipated outcomes are necessary for a successful project, but they are not sufficient. The Foundation expects that projects should add to the base of knowledge about how teachers can most effectively be prepared and subsequently aided to enhance their capabilities. A project that achieves the goal of aiding individual teachers (and, indirectly, their students) can also serve as an exemplar for other projects, thus broadly improving the quality of science and mathematics teaching.

The Division of Teacher Preparation and Enhancement supports projects that promote these objectives while adding to our knowledge about activities that prepare teachers in the content and the teaching methods that promote effective learning by students at each school level; enrich teachers' expertise for professional leadership and peer teaching; provide encouragement and opportunities for teachers to enhance and develop their capabilities; and provide dissemination opportunities that actively involve elementary, secondary, and college teachers in exchanging ideas that improve their own teaching.

In pursuit of this knowledge, the Division of Teacher Preparation and Enhancement encourages projects that:

- capitalize on the prestige associated with an NSF grant and exploit the Foundation's unique familiarity and relationship with the scientific research and education community;

- stimulate collaboration among such partners as the Federal government, colleges and universities, state and local education agencies, business and industry, cultural institutions and media, scientists and science educators, and teachers, school administrators, and parents;

- result in self-sustaining networks among these varied elements -- cooperative patterns that will continue to function, supported by non-NSF funds; and,

- focus resources, exert high leverage, and provide widely applicable approaches to strengthening science and mathematics education.

TEACHER PREPARATION PROGRAM

This program supports innovation in the preservice education of future teachers of mathematics and science. In addition to the efforts of the Program to improve regular teacher education curricula, emphases are placed on: building capability in more than one discipline; recruitment to science and mathematics teaching, especially of women, minorities, and disabled persons; curricula based on research in teaching and learning; and strengthening teacher curricula in the use of advanced technologies.

TEACHER ENHANCEMENT PROGRAM

The Teacher Enhancement Program provides support for a wide variety of prototypical model projects for inservice improvement of the qualifications and effectiveness of mathematics and science teachers. Proposals for the support of general teacher enhancement projects are welcomed. In addition, the Foundation invites proposals for:

- Projects that focus the attention of teachers at the elementary and middle school levels on techniques for increasing classroom effectiveness in science and mathematics through the use of advanced educational technology.
- Programs, involving middle and secondary school teachers, to develop methods for sustaining the enthusiasm that elementary school students exhibit toward science and mathematics, and that explore techniques for attracting minority, female, and disabled students to the continued study of science, mathematics, and technology.
- Projects that will develop sound ways to improve the capability of secondary school teachers to teach combinations of related subjects (e.g., chemistry and earth sciences, physics and mathematics, or chemistry and physics).
- Projects to develop a continuing evaluation of NSF's completed teacher enhancement projects, and mechanisms for disseminating information about them.

SCIENCE AND MATHEMATICS EDUCATION NETWORKS PROGRAM

An education "network" is an interconnected set of individuals, institutions, entities, or groups organized to share information, resources, and/or talent in service of a general or specific educational objective -- often, the improvement of some aspect of the delivery of educational services.

The Science and Mathematics Education Networks Program supports the initiation and development of local and regional networks among individuals and organizations for both general and specific efforts to improve education in mathematics, technology, and the sciences.

In addition to funding proposals received from the field, the Network Program funds or coordinates specific activities aimed at improving communication and coordination among the various groups active in the nation-wide effort to improve mathematics and science education. The Network Program will encourage:

- Projects designed for consensus building or the exchange of ideas related to future direction for the improvement of mathematics, science, and engineering education.
- A project or projects designed to disseminate exemplary models, instructional materials, assessment information and research findings.
- Coordination and collaboration with major organizations active in the improvement of education.

The Foundation is especially interested in fostering partnerships between industrial and other private sector entities and school districts to address specific local or regional needs in science, mathematics, and technology education.

PRESIDENTIAL AWARDS FOR EXCELLENCE IN SCIENCE AND MATHEMATICS TEACHING

This is an initiative of the Office of the President of the United States to provide national recognition for distinguished middle and secondary school teachers of science and mathematics. Teachers eligible for this award are those whose primary responsibility is classroom teaching of science or mathematics in a public or private middle/junior or senior high school in each of the fifty states, the District of Columbia, and Puerto Rico.

A minimum of five years teaching experience in science or mathematics is required.

Awardees receive national recognition and their schools each receive a two-year $7500 NSF grant to be used, under the direction of the awardee, for improving the science or mathematics instructional programs in their school districts. The involvement of these nationally recognized teachers in leadership activities to promote and improve science and mathematics education is encouraged.

OFFICE OF STUDIES AND PROGRAM ASSESSMENT

Continuous efforts are required to inform and guide the processes of planning, initiating, operating, and terminating programs designed to meet specific needs and address particular trends. Such efforts are based on information about current trends and effectiveness, and on policy studies in areas of current significance. Within the Directorate for Science and Engineering Education, the development of such information and support of related policy studies is the responsibility of the Office of Studies and Program Assessment, which collaborates with other NSF entities and with the U.S. Department of Education.

The goals of the Office of Studies and Program Assessment (OSPA) are to:

- Develop improved indicators of student achievement (in both basic and higher order skills), teacher quality, and curriculum effects;
- Provide data of national scope on significant problems and opportunities in science, mathematics, and engineering education, together with international comparison information;
- Support policy studies pertinent to deliberations regarding the strengthening of such education in the United States; and
- Provide information that will assist in setting priorities and plans for the Foundation's education activities, in part through design, development, and implementation of ongoing evaluation procedures for NSF's science, engineering, and mathematics education programs.

STUDIES AND ANALYSES PROGRAM

The collection, study, and analysis of data on science and engineering education issues of both continuing and timely concern, and support of related policy studies and policy development, are the domain of the Studies and Analyses Program. Areas of major interest are teacher supply and qualifications, student interests and achievement, and curriculum content and impact - at all levels of instruction.

Proposals funded under this program are intended to: (1) provide data of national scope on significant problems and opportunities in science, mathematics, and engineering education, that would be useful for policy deliberations regarding the strengthening of such education in the United States; and (2) provide information that will assist in setting priorities and plans for the Foundation's science education programs. Proposals are invited for new data collection as well as for synthesis or secondary analysis of existing information.

Participation of scientists, mathematicians, and engineers grounded in the disciplines being studied is encouraged. Their contributions are essential because they provide not only subject matter expertise but insight into the issues germane to science education and in need of explication.

ASSESSMENT ACTIVITIES

The Directorate for Science and Engineering Education (SEE) has initiated a systematic set of studies to gauge, on an ongoing basis, the quality and impact of the National Science Foundation's educational activities. The purpose is to assist NSF in its continuing efforts to enhance the effectiveness of its work. Findings of the studies also will inform outside audiences about implementation of the Foundation's programs.

Because of the importance of content to science, mathematics, and engineering education, and the special ways in which "knowing" evolves in these fields, there must be both (a) appropriate participation by scientists, mathematicians, and engineers, and (b) collaboration with evaluation specialists in the design and execution of assessment studies proposed to the Foundation.

SEE pursues its mission through a number of broadly-defined programs, each of which supports individual and sometimes numerous projects. Accordingly, the planning and related assessment activities of SEE take place on two different but interrelated levels:

- At the program level, the yardsticks relate to the Directorate's mission and basic goals; assessment provides information on the contributions and potential of various programs, so that current and alternative ones can be compared.
- At the project level, attention focuses on program goals and the aggregate impact of current projects. Appraisal provides information about the effectiveness of individual projects; identifies strengths that should be propagated and weaknesses to be avoided in the selection of future projects; and in other ways informs program officers as they adjust the project mix to achieve the goals of each program.

DIVISION OF UNDERGRADUATE SCIENCE, ENGINEERING AND MATHEMATICS EDUCATION (USEME)

(Formerly, the Office of College Science Instrumentation).

USEME is responsible for:

- Management of undergraduate program activities budgeted within the SEE Directorate;
- Coordination across the Foundation of the NSF mission in undergraduate education; and
- Stimulation of the involvement of academic scientists, their institutions, the State, the private sector, and other Federal agencies in efforts to improve undergraduate education in mathematics, engineering, and the sciences.

With its responsibility for the administration of some programs and for the coordination and management of others, USEME's task, broadly, is to bring the resources of *all* of the NSF Directorates effectively to bear on the improvement of undergraduate education in all fields of concern to the Foundation.

COLLEGE SCIENCE INSTRUMENTATION PROGRAM

NSF's undergraduate instructional College Science Instrumentation Program is designed to develop and implement new approaches to improve the effectiveness and efficiency of laboratory instruction, especially through use of modern instrumentation.

The specific objectives are to encourage and support:

- Introduction of modern instruments to improve the experiences of undergraduate students in science and engineering courses, laboratories, and field work;
- Interfacing of computers with scientific instrumentation and other appropriate uses of current technology in science and engineering instruction;

- Development of new instrumentation and new ways of using instrumentation to extend instructional capabilities; and

- Establishment of equipment-sharing capability via consortia or centers.

Projects in two broad categories will be supported:

- Instrumentation - model and standard-setting projects to improve the quality of laboratory instruction through creative use of modern instrumentation and advanced technology.

- Laboratory Improvement - the conception, design, creation, and testing of new approaches that are cost effective, powerfully stimulative of learning, and that reflect actual science and engineering practice.

FACULTY ENHANCEMENT PROGRAM

This Program, newly established in FY 1988, will support projects that will assure that the teaching faculties of the nation's colleges and universities remain vigorous and current in their disciplines. The Foundation's faculty-oriented activities at the undergraduate level will stimulate new ways (and share in the support of the best traditional ways) of improving the professional qualifications of college and university faculty through continuing education or active involvement in forefront research activities.

Seminars, conferences, and other mechanisms may be proposed that will:

- allow participants to gain experience with recent developments in the field;

- enable participants to work with innovative technologies relevant to their academic responsibilities and which allow them to evaluate the technology;

- permit participants to work with experts who have had a part in originating the ideas which are the subject of the project or who have worked extensively with the ideas or techniques;

- permit participants to obtain personal experience working with new ideas and techniques, rather than just hearing about them;

- encourage participants to develop instructional materials that include new ideas and techniques;

- explore new methods of delivery of information, such as their use of computers or teleconferencing, either in work with other participants during the projects or in participants' activities after the project;

- encourage sustained interaction among the participants following the project and continued opportunities for learning about the topics of the project;

- encourage the increased participation of underrepresented groups in science, mathematics, and engineering.

CAREER ACCESS OPPORTUNITIES PROGRAM

Successful precollege programs to increase the numbers of women, minorities, and the disabled who are attracted to technical careers must be followed by college-based programs of the same type and intent if the strong drift toward non-technical careers between high school and college is to be countered. This newly-established Program will support projects of two types:

(1) Comprehensive Regional Centers for Minorities will be supported at institutions with significant minority enrollments to:

- develop institutional capability in undergraduate science, mathematics, and engineering education for minority students (particularly at the freshman and sophomore levels);

- develop cooperative activities, with regional precollege schools having substantial minority enrollments, to improve science, mathematics, and engineering education and to coordinate and facilitate the transition of minority students from high school to college status;

- stimulate and coordinate the efforts of other colleges and universities in the region, with substantial minority populations, to strengthen their undergraduate programs in science, mathematics, and engineering, and to serve as foci for additional cooperative activities in precollege science, mathematics, and engineering education;

- take a leadership role in nurturing and encouraging minority students to undertake graduate studies in science, mathematics, and engineering by increasing the opportunities for such activities and by stimulating minority students confidence and interest; and

- enhance the potential for stable, long-term continuation of the NSF-supported activities.

(2) Prototype and Model Projects for Women, Minorities and the Disabled will be supported in colleges, universities, and other eligible organizations to design and create special instructional and outreach activities to increase the participation of any of these underrepresented groups in careers in science, mathematics, and engineering.

COURSE and CURRICULUM PROGRAM

In FY1988 USEME implemented a pair of NSF curriculum redevelopment programs. One is devoted to improving instruction in the calculus - the basic collegiate mathematics course taken by all scientists and engineers - through support of revision and renewal of the calculus curriculum. The other will support a number of large-scale experiments in rethinking, revising, and restructuring the undergraduate curriculum in engineering; it is being co-funded by the Directorate for Engineering. USEME also will receive proposals for study and assessment of the condition of the curriculum in other major disciplines, such being antecedent to the initiation of additional curriculum redevelopment efforts.

DIVISION of RESEARCH CAREER DEVELOPMENT

A continuous flow of many of the Nation's brightest young people into careers in science and engineering is of immense national importance, and the critical Federal role in ensuring this flow has nearly universal support. Assurance of a ready pool of highly qualified scientists and engineers is crucial in a nation whose security and economic well-being depend on science and technology.

Because of this, for 35 years the National Science Foundation has, in a variety of ways, led in developing and broadening the pool of students who enter advanced study for careers in science and engineering. The programs of the Division of Research Career Development in the Directorate for Science and Engineering Education deal with four groups of young and becoming scientists, mathematicians, and engineers:

1. Beginning graduate students;

2. Young postdoctoral students seeking international study and research experience;

3. Junior faculty in areas of critical personnel shortage in industry and academia; and

4. Young Scholars -- precollege students showing exceptional aptitude in science.

(Activities 2 & 3 are managed by Directorate for Science and Engineering Education staff, but are funded from sources external to the Directorate.)

Nominations, applications, and proposals related to these activities are scheduled annually by the Division of Research Career Development.

1. Beginning Graduate Students. The Directorate supports graduate level training and education primarily through awarding fellowships.

Since 1952 the Foundation has awarded Graduate Research Fellowships annually to a group of the Nation's most talented graduate students in science and engineering. These three-year awards provide recognition and support for the Fellows, and are insurance for the Nation that talented scientists and engineers in a wide variety of fields will be available to address the problems at the research frontiers of the future. Persons awarded Graduate Research Fellowships are permitted to undertake their tenures at the graduate institutions of their choice.

- The awards carry stipends for the Fellows and allowances for their institutions in lieu of all required tuition and fees. The stipend level is currently $12,300 annually ($1,025 per month) and the institutional allowance is $6,000 per year.
- The number of new awards made each year will increase from 560 in FY 1987 to 1060 by FY 1991.

Since FY 1978 this activity has operated with two component programs: Graduate Fellowships and Minority Graduate Fellowships. The latter program receives 10% of activity resources, and is identical to Graduate Fellowships except that applications are limited to members of ethnic minority groups underrepresented at the advanced levels of science and engineering.

2. International Postdoctoral Study. The Directorate for Science and Engineering Education, on behalf of the Foundation and at the request of the U. S. Department of State, manages the United States component of the NATO Postdoctoral Fellowships in Science Program.

Since 1959 each NATO member country has received an allocation from NATO to be used by its own nationals in international study and research. The objective is to promote scientific understanding and cooperation among member countries. The U.S. allocation is used to support fellowships at the postdoctoral level for scientists and engineers within five years of their Ph.D.'s. Fellows must study outside the United States in a NATO or closely allied nation.

- NATO Postdoctoral Fellows receive a stipend of $19,200 per year, with small additional allowances for dependents, travel, and institutional costs. Current funding permits offers of about 50 awards per year.

3. Junior Faculty Awards. The National Science Foundation assists universities to improve their capability to respond to the demand for highly qualified scientific and engineering personnel for academic and industrial research through the Presidential Young Investigator Awards Program.

The program was initiated in 1984 by the National administration. It is funded within the Foundation by the several research directorates and is coordinated by staff of the Directorate for Science and Engineering Education.

The activity focuses on the Nation's most promising young faculty and potential faculty, and seeks to put in place the highest quality faculty members for educating the next generation of professional scientists and engineers.

- Presidential Young Investigator Awards carry a base annual grant of $25,000, which can be augmented by the NSF up to an additional $37,500 on a dollar-for-dollar match of contributions from industrial sources. Awards are renewable up to a total of five years. In addition to Federal and industrial contributions, the awardees' institutions share by providing their academic year salaries.
- The awards are made on the basis of a national competition among individuals nominated by Ph.D.-granting institutions. Approximately two hundred first year awards are made each year.

4. Young Scholars. This activity, newly established in FY1988, focuses directly on middle and high school students. It is designed to stimulate permanent interest in mathematics, science, and engineering, and especially to do so with a view to helping the student maintain options. Such activities identify, motivate and educate participants to help them sharpen their abilities to make informed career choices, to ready themselves for the sequence of elections necessary if they are to stay "on track", and to help them increase their academic competitiveness. These activities have a strong focus on outreach to and involvement of members of underrepresented groups, with the goal of increasing ultimately their participation in the advanced levels of science and engineering.

The Young Scholars Program, for talented middle and secondary school students, reached approximately 2500 students in its first year, 1988. Beginning in 1989, and thereafter, the program is expected to reach 4000 students annually.

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NATIONAL SCIENCE FOUNDATION
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ALABAMA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

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Mathematics
Thurgood Marshall Middle School
Evergreen, AL

Dorothy E. Dale
Science
Huntsville High School
Huntsville, AL

1988

Peggy Harrell
Mathematics
Shades Valley High School
Birmingham, AL

Suzanne P. Alexander
Science
Central High School-East
Tuscaloosa, AL

COLLEGE SCIENCE INSTRUMENTATION

Leo Pezzementi USE 8750089
Birmingham Southern College FY87 $22,046
Birmingham, AL Biology

"Equipment for a Modern Undergraduate Cell Biology Laboratory"

In this project, students will be introduced to some of the instruments, techniques, and concepts of modern Cellular and Molecular Biology through a series of experiments performed with primary cultures of skeletal muscle cells prepared from chick embryos. The new equipment provided through this project consists of a biological safety cabinet and controlled-atmosphere incubator for the preparation, maintenance, and incubation of cell cultures of skeletal muscle (a cell type that differentiates in vitro and lends itself to a variety of cell biology experiments), an ultra-low-temperature freezer for the storage of perishable materials needed for cell culture, a liquid scintillation counter, micro-computer and associated software for the quantification, analysis, and presentation of the results of radiobiological experiments designed to investigate the rates of synthesis, degradation, transport, and secretion of muscle proteins, and three gel electrophoresis units for the determination of the molecular weight and identity of muscle-specific proteins.

These experiments will allow students to use a variety of techniques from modern Cellular and Molecular Biology to explore some of the fundamental properties of living cells.

COLLEGE SCIENCE INSTRUMENTATION

Richard D. Holland USE 8851894
Livingston University FY88 $15,000
Livingston, AL Biology

"Equipment for Improving Undergraduate Laboratories in Cellular Biology"

The acquisition of state-of-the-art instrumentation for under-graduate laboratories in Cell Biology is correcting this department's deficiencies in areas of functional biology. The acquisition of a dismembrator, a centrifuge and a refrigerated circulator allow for the isolation of cellular organelles; the electrophoresis unit and spectrophotometer -- the characterization of organic compounds; the clean bench, shaker, incubator and chromatography refrigerator -- the isolation and maintenance of cell cultures.

The new equipment and instrumentation are making it possible to place needed emphasis on modern biotechnology and functional biology. Improved laboratories in Cell Biology are increasing student success in these courses and enhancing their readiness for professional pursuits.

The grantee institution is matching the NSF award with a more-than-equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

James D. Fisk USE 8750054
Samford University FY87 $26,000
Birmingham, AL Chemistry

"Improvement of Undergraduate Instruction in Chemistry through NMR"

The effectiveness of teaching concepts of spectroscopy has been improved by the Chemistry Department at Samford University through the recent acquisition of a nuclear magnetic resonance (NMR) spectrometer. Students are learning NMR principles and applications of magnetic resonance to chemical structure, first hand, by obtaining NMR information on different types of compounds and correlating this data with NMR theory as well as other spectroscopic information. This results in a composite "picture" of the molecule, and teaches students how chemical structure can be investigated. The instrument is used exclusively by undergraduate chemistry majors and minors in a number of chemistry courses in which a carefully planned group of experiments teach various aspects of the technique in a logical sequence that builds on what students have already learned. This equipment complements existing instrumental holdings and gives the department a more complete arsenal of analytical tools through which to teach spectroscopic methods.

COLLEGE SCIENCE INSTRUMENTATION

Janice B. Woodall	USE 8852299
Southern Union State Junior College	FY88 $21,022
Wadley, AL	Chemistry

"Modernization of Instrument-Based Chemical Laboratory Education"

The quality of chemistry course offerings is being improved both in terms of coverage as well as in facilities and equipment. Accordingly, a complete renovation and reassessment is being made to upgrade and improve the general and organic chemistry courses currently offered with special emphasis on instrumentation. The PI is spearheading the major improvement plan. The major equipment being added to the basic general and organic chemistry laboratories includes a computer and accessories, a student model gas chromatograph, an infrared spectrophotometer, balances, pH meters, a polarimeter, a Spectronic 20 as well as other minor items. The introductory and organic lecture sequence is also being totally revised to reflect the availability of the new equipment.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Barbara R. Hatton	TPE 8751344
Tuskegee Institute	FY87 $136,526
Tuskegee, AL	FY88 $131,147
	FY89 $ 90,922
	Elem Sci/Math

"The Tuskegee-Macon CADRE in Science and Math (A Collaborative Alliance for Development of Resource Educators)"

This project is designed to improve mathematics and science instruction in a rural Alabama school system by training the existing elementary and middle school teachers. It is a collaborative effort between the Macon County School System and the faculty of the College of Arts and Sciences and School of Education at Tuskegee University.

Project activities include: (1) workshops to improve the science and mathematics knowledge of teachers; (2) the development and utilization of demonstration classrooms for the classroom application of teacher knowledge in science and mathematics; and (3) leadership development through administrator workshops and the preparation of teacher consultants to ensure effective instructional change beyond the life of the project.

The central focus of the project is the development of a cadre of twenty teacher consultants who will receive sufficient preparation to serve as resources to their classroom peers. This strategy involves a multi-stage process of in-school training, university instruction, and teacher consultation.

In the first year, approximately 117 teachers and 7 administrators will be trained by university personnel. Of these, 20 teachers will be selected for further training in the second year to serve as lead teachers for the training of teachers at additional school districts during the third year of the project. Expected training outcomes are (1) increased teacher knowledge; (2) more effective instructional delivery by teachers; (3) improved student performance; and (4) demonstration classrooms as a teacher resource and for use in the clinical experiences of university teacher trainees.

TEACHER ENHANCEMENT PROGRAM

Louis Dale	TPE 8751674
University of Alabama at Birmingham	FY88 $284,404
Birmingham, AL	Mathematics

"Teacher Enhancement and Effective Transition from Junior High to High School Mathematics"

This two-year project will address the difficulties presented by the transition from junior to senior high school mathematics by enhancing the mathematical and pedagogical skills of teachers in a setting which fosters cooperation between teachers at the two levels. Each year, forty underprepared teachers -- half from grades 7 and 8, and half from grade 9 -- will participate in a six-week summer workshop that includes courses in probability and statistics, as well as a seminar on issues in mathematics education. Each junior high teacher will work jointly on a project with a high school teacher. The academic-year follow-up consists of classroom visitations by the project staff and nine workshop-seminars for participants.

The project will enable participants to use probability and statistics as a means of reinforcing basic skills while developing their students' higher-order thinking skills. It also will provide a model of constructive interaction between junior and senior high school teachers. The project represents a collaboration between the University of Alabama at Birmingham and the Birmingham Public Schools, each of which contributed significant cost-sharing to the project.

TEACHER ENHANCEMENT PROGRAM

Lee R. Summerlin TPE 8850435
Larry K. Krannich FY88 $129,689
University of Alabama at Birmingham Other NEC
Birmingham, AL

"Enhancing Junior High Science Teachers Background Through the Development and Utilization of Relevant Laboratory Activities in Chemistry"

Twenty-five junior high school science teachers from the Central Alabama area will be selected to participate in a project designed to give them practical laboratory experience and update their chemistry background. The chemical activities will be patterned after those in Chemical Activities, a recent publication from the American Chemical Society. This program consists of over 100 chemical and physical science activities suitable for junior high students. It has also been approved by a safety committee of the ACS for student use.

The primary objective is to give this group of teachers suitable background in the appropriate chemical topics in order to implement these activities in their classrooms and laboratories. Application of chemistry to social and environmental issues will be stressed and activities that relate chemistry to everyday life will be emphasized.

An instructional format of monthly two-day sessions followed by a week-long summer session will be used. Extensive follow-up activities are planned with visits to participants' schools by project staff and at least two regional day-long conferences in which participants will share their experiences.

The University of Alabama and the participating school districts are contributing the equivalent of 10% of the NSF grant.

YOUNG SCHOLARS

John Dindo RCD 8850252
Robert Shipp FY88 $21,938
Jenny Cook FY89 $21,938
University of South Alabama Life Science
Mobile, AL

"Students in the Sea"

The NSF Students In The Sea program offers 25 high school students a two-week exposure to the real world of marine science by working with scientists. Students participate in the Discovery Hall summer program focused on the world of oceans. Scientists take students aboard the 70-foot research vessel A. E. Verrill where they collect oceanographic, geologic, and biologic data. Ten noted scientists work directly with the students in the field and laboratory.

The excitement of learning about the sea at the sea coupled with the exposure of these students to highly talented men and women can stimulate their career goals toward the sciences.

COLLEGE SCIENCE INSTRUMENTATION

Francis M. Donovan, Jr. USE 8852321
University of South Alabama FY88 $34,992
Mobile, AL Mechanical Eng

"Undergraduate Controls Laboratory"

This project extends the use of an existing instrumentation laboratory by incorporating programmable control capability. The major items of equipment are eight programmable controllers with the necessary computers and software. A number of transducers and associated equipment are also used in this lab.

The equipment is used by engineering juniors and seniors to study experimental aspects of automatic control. They experiment with control of processes and machines without undue circuitry design and construction. These students gain proficiency in an area of engineering which is in increasing demand in today's industry.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Russell M. Hayes, Jr. USE 8750613
University of South Alabama FY87 $16,317
Mobile, AL Electrical Eng

"Introduction of an Advanced Undergraduate Software Development Station"

This project is to enhance the senior engineering design project laboratory with a software development station. It is an extension of the existing undergraduate laboratory instruction which is based on the Motorola Educational Computer Board and using the MC68000 assembly language. The station reflects the latest in microprocessor emulation, and will be based on the IBM PC/AT with a 68000 co-processor module. Using emulators for the 68000, 6809, and 68HC11, a variety of design projects can be supported in the area of digital signal processing and control.

COLLEGE SCIENCE INSTRUMENTATION

Wayne C. Isphording	USE 8852952
University of South Alabama	FY88 $46,000
Mobile, AL	Geology

"Organic and Inorganic Compounds in Marine and Transitional Marine Environments: A Training Experience for Undergraduate Science Majors"

The grantee institution will purchase an automated X-ray diffractometer which will be used to improve instruction in the analytical methods course for geology, biology, and chemistry students. In addition to being used to train students in the methods of solid state organic and inorganic phase analysis, the equipment will be used by advanced undergraduate students to carry out research projects in environmental science.

The grantee will match the NSF grant with an equal amount of funds plus 4%.

COLLEGE SCIENCE INSTRUMENTATION

Edmund Tsang	USE 8851334
University of South Alabama	FY88 $8,445
Mobile, AL	Materials Eng

"Undergraduate Metallurgy Laboratory Improvement"

This project provides hands-on experience for undergraduate mechanical engineering students on modern corrosion testing and measurement equipment. The equipment funded for this laboratory enhancement includes: a potentiostat, a corrosion cell, interface for a PC, and corrosion software. This equipment is used to measure corrosion current and corrosion potential of common engineering materials in different service environments, and to study the electrochemical principles of corrosion.

The project is significant because the equipment serves as a teaching tool to give junior-level students experience with corrosion principles and it builds on experience with modern instrumentation that students have acquired in sophomore-level course.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

William A. Ward, Jr.	USE 8750616
University of South Alabama	FY87 $50,000
Mobile, AL	Computer Science

"Unix Based Graphics Work Station Laboratory for Computer Science Students"

This Project is to develop a graphics workstation laboratory. The equipment will be used in a sequence of four junior and senior level computer science courses to demonstrate modern methods in software engineering and computer graphics. Students will acquire expertise in such methods by using state-of-the-art instrumentation to implement software projects which illustrate theoretical results in those fields. The project focuses on the use of graphics tools as visual aids for the design and analysis of software and on the use of those tools in the development of graphics software itself. The equipment includes a color monitor and four workstations for a student laboratory and a file server and one workstation for a faculty laboratory. The server, a high-speed microprocessor with a disk drive, provides disk space and additional computing power to the workstations. Eight existing PCs will be connected to the server; four will be placed in the student laboratory and four in faculty offices. Both laboratories will be housed in a newly remodeled facility. Project implementation spans a 2-year period with ample personnel available for equipment installation and course preparation.

ALASKA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Gary A. Laursen
Science
West Valley High School
Fairbanks, AK

Sandra M. Schoff
Mathematics
West Anchorage High School
Anchorage, AK

1988

Joann L. Walker
Mathematics
Kotzebue Middle School
Kotzebue, AK

Larry W. Read
Science
Clark Junior High School
Anchorage, AK

CAREER ACCESS OPPORTUNITIES

Eber Hampton	USE 8850690
Stephen F. MacLean, Jr	FY88 $150,296
University of Alaska Fairbanks Campus	Other NEC
Fairbanks, AK	

"Action for Access"

This model project includes, in the first year of operation, several activities to strengthen minority education at the precollege level and to improve the transition of Native Alaskan students into college and university. It was developed under the leadership of the University of Alaska with the cooperation of the school systems in Alaska, Native organizations and corporations, industry, and State Agencies. During the first year, a set of activities based on science and mathematics experiences, and designed to nurture, encourage and motivate minority students, are being implemented. These consist of a one-year sequence of four phases to prepare students in precollege mathematics, science, and study skills by providing instruction in mathematics and science as well as incorporating internships and science research projects specifically related to Native and rural activities in Alaska. The four phases are: five-weeks of intensive academic instruction at the University of Alaska, including an introduction to Biology, Chemistry, Basic Mathematics, and a seminar on Culture, Ideas, and the Values of Science; distance delivery instruction in which academic coursework will be continued by delivery to students' home sites; a return to the campus for further laboratory experience; and, a career counseling support activity to encourage enrollment in college-level science courses. Plans for the second year will include science and mathematics activities at the undergraduate level.

This project is co-funded with the NSF Directorate for Geosciences.

YOUNG SCHOLARS

Robert C. Harcharek	RCD 8850094
Shirl Spelgatti	FY88 $33,178
University of Alaska Fairbanks Campus	FY89 $33,178
Fairbanks, AK	Environmental

"Science Field School Project for Alaskan North Slope Pre-College Youth"

The University of Alaska-Fairbanks works with schools across the North Slope of Alaska to provide 30 youth in grades eight through twelve with science field school experiences during the summer of 1988. Each experience is offered in conjunction with an agency or organization which is conducting scientific research on the Alaskan North Slope. Students travel from their homes to actual research sites where they become involved in research methods and scientific discovery with the guidance and support of field scientists. Activities include technological studies in marine science, archaeological artifact analysis, soil core sample analysis, wildlife census counts, land use surveys and caribou route mapping. Students are exposed to various career opportunities related to the research projects in which they are involved.

TEACHER PREPARATION PROGRAM

James Stricks	TPE 8652480
Ed Cridge	FY88 $200,209
Donald D. Gibler	FY88 $ 42,712
John L. Morack	FY89 $ 28,451
Patricia A. Nelson	Physics
University of Alaska Fairbanks Campus	
Fairbanks, AK	

"Improving Science Education of Prospective Field-Based Alaska Native Teachers"

"Improving the Science Education of Prospective Alaska Native Teachers", is part of a cross-cultural, field-based teacher preparation program for native Alaskan students. The project will develop, test, and disseminate two laboratory science courses, one in chemistry and one in physics, that are especially appropriate for Native Alaskan students who are prospective elementary school teachers. For the most part, the courses will be offered at field sites and will incorporate appropriate and locally relevant laboratory/practical activities. A team of university science faculty, educational consultants, rural science teachers, native students and others will develop and produce science course prototypes that accommodate and incorporate the students' culture and environment. The third year of the project includes final development of course materials, evaluation, and dissemination.

Despite many attempts to improve the success in science of Native Alaskan children, a vicious cycle of low interest and low achievement continues. This reality results in failure not only at elementary and secondary levels of schooling but also at the university level as well. Thus, the number of Native Alaskan students selecting science oriented majors or careers is minuscule, and prospective Native teachers have very poor science preparation perpetuating the problem. This project will respond to the problem by preparing Native Alaskan elementary school teachers who have been successful in science and who will serve as scientifically literate role models for their students and communities.

TEACHER PREPARATION PROGRAM

Neal B. Brown
University of Alaska
Geophysical Institute
Fairbanks, AK

TPE 8817540
FY88 $25,000
Other NEC

"Rural Education in Alaska"

The Arctic Division of the American Association for the Advancement of Science holds an annual conference either in Alaska or western Canada. The 1988 Conference will be held in Fairbanks, Alaska, October 7-10, 1988. The theme of the Conference is Science Education and is being organized by the University of Alaska in conjunction with the Fairbanks North Star Borough School District. This project seeks funding to provide travel assistance to secondary school educators from the far-reaches of the State of Alaska. The Conference is being held in Fairbanks to coincide with the local teacher-in-service training periods. Several hundred secondary school educators are expected to attend and be joined by several hundred scientists from Alaska and Canada and speakers from non-Alaskan institutions and organizations. Workshops, special sessions, and keynote speakers will cover a wide range of science education needs and solutions unique to remote northern regions, including content, concepts, delivery techniques and training. Scientists and educators at all levels will have the opportunity to discuss approaches, successes and failures in motivating rural and native students for science and engineering careers.

This project is co-funded with the NSF Directorate for Geosciences.

ARIZONA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Donald F. Galen
Science
Central High School
Phoenix, AZ

John M. Jensen
Mathematics
Horizon High School
Scottsdale, AZ

1988

David L. Byrum
Science
Flowing Wells High School
Tucson, AZ

Donna R. McCarthy
Mathematics
Desert Sky Junior High School
Glendale, AZ

YOUNG SCHOLARS

George C. Beakley	RCD 8850155
Robert W. Hinks	FY88 $66,160
Donovan L. Evans	FY89 $66,160
Harry R. Lundgren	Engineering
Arizona State University	
Tempe, AZ	

"The NSF Young Engineering Scholars Program at Arizona State University"

This Arizona State Young Scholars project is designed to give approximately thirty selected high ability and high potential secondary school students an unusual learning experience in engineering. An annual summer residential course focuses on participant skill development in logic, creativity, analysis, and communication. A series of state-of-the-art drawing laboratories offers students experience in creative expression through freehand, and computer-aided drawing. Participants practice artifact design and analysis in computer analysis laboratories using electronic spreadsheets. Interesting design problems are assigned, both for seminar discussion and investigation.

Lectures, workshops and seminars examine pertinent topics such as the role of mathematics and science in engineering, the philosophy, professional responsibilities and ethics of engineering, modern challenges facing engineers, and the connection between engineering and the "liberal arts". Field trips show students selected engineering research and manufacturing establishments, including the Jet Propulsion Laboratory in Pasadena, California.

TEACHER ENHANCEMENT PROGRAM

Frederick A. Staley	TPE 8651468
Frances P. Lawrenz	FY86 $154,018
Arizona State University	FY87 $171,899
Tempe, AZ	FY89 $123,618
	Other NEC

"A School-Industry-Community Approach to the Development of Scientific and Technological Literacy Among Elementary School Pupils"

This project is designed to implement and sustain a scientific-and technological-literacy-for-all-students approach in elementary schools in Arizona. An action plan will be developed by each school community and will include the following features: a) designation of the school principal as the facilitator of school community change, b) selection of a science instructional leader who will receive special preparation in a science, technology, society, and science education academy, c) design of vehicles for the sharing of up-to-date science and technology information by the science instructional leader with other teachers and children, d) development of interdisciplinary, instructional thematic units which provide up-to-date technology learning experiences to supplement the existing science and social studies programs, and e) involvement of community businesses, industries, informal education agencies and key parents.

A variety of useful products and outcomes will be developed including:

a) A Science, Technology, Society Curriculum Data Bank which will enable sharing of such resources as: thematic units developed by teachers; newsletters on science and technology; reviews of relevant videocassettes; reviews of relevant television programs; reviews and suggested use of locally available curriculum materials; information about community resources, computer software programs, pamphlets, brochures, and films.

b) A report about effective strategies and approaches for creating thematic units that utilize local resources, deal with societal issues, and have local and community relevance and practicality for students.

c) Suggestions about effective strategies and techniques for implementing thematic units with children in classrooms.

d) Descriptive, longitudinal and comparative research data about the process and effects of attempting to bring about substantial change in the science curriculum utilizing two different sequences of teacher preparation and implementation.

PRIVATE SECTOR PARTNERSHIPS

David W. Hammer	TPE 8851032
Institute for the Support of Educational Excellence	FY88 $54,691
	FY89 $95,309
Glendale, AZ	Mathematics

"A Pre-Algebra Summer Enrichment Program for Students in Transition"

Over a three-year period, this program will refine, implement, and evaluate a four-week intensive summer enrichment program in pre-algebra skills for eighth grade students who are in transition from elementary to high school. One hundred students will participate for each of three summers. It is based on a unique, successful experimental class held during the summer of 1987. The program is a collaborative effort involving scientists, engineers, and mathematicians from a number of local industries who will demonstrate practical applications of math in the work place. Students will be bused to nearby locations for on-site demonstrations as part of the program. In addition, faculty from Arizona State University will provide information on careers in science/math/technology as part of the partnership program.

Student interest in mathematics, knowledge of careers in science/math/technology, student achievement in science and math and enrollment in upper division science and math courses are predicted to increase as a result of implementation of the proposed program. An extensive evaluation component with longitudinal tracking of students is included in the model. Also included in the model for transfer to other teachers and other school districts are ways to organize and operate such a program, and information on successful instructional practices and materials.

Cost sharing by the corporate and educational partners will total 43% of the NSF funding.

TEACHER ENHANCEMENT PROGRAM

Thomas G. McAndrews	TPE 8751290
Gloria J. Sternberg	FY87 $149,556
Peggy E. Peterson	Elem Science
Carleaton S. Nuhn	
Patricia Dolan	
Mammoth-San Manuel Unified Sch Dist	
San Manuel, AZ	

"Improving Elementary Science Education"

This project addresses teacher-identified deficiencies in science instruction: low self-confidence, inadequate knowledge, and poor curriculum materials. The purposes of the project are two-fold: 1) to provide K-8 teachers with enough science content training and teaching strategies to implement a locally developed and comprehensive curriculum; and 2) to offer a coordinated dissemination/training model to rural districts utilizing local master teachers, the Pinal County Superintendent's Office, and the Arizona Department of Education.

Participating districts will benefit by complying with Essential Skills mandates; improving instruction in K-8 Physical, Earth, and Life Science and Health; and in-depth training in Cooperative Learning, Guided Discovery, and the Learning Cycle.

COLLEGE SCIENCE INSTRUMENTATION

James A. Collier	USE 8853142
Mohave Community College	FY88 $11,165
Kingman, AZ	Biology

"Undergraduate Biology and Chemistry Instrumentation for Freshman and Sophomore Laboratories"

The goal of this project is to modernize and improve freshman and sophomore biology and chemistry laboratories on the three campuses of a remote two-year college that enrolls large numbers of Native Americans, many of whom are female. The new equipment being incorporated into the teaching program includes plant growth chambers, marine aquaria and computer-interfaced physiology instrumentation. The environmental chambers enhance the school's ability to conduct General Biology laboratory experiments involving plant competition and animal metabolism. The salt-water aquaria are used to expose General Biology students (most of whom are completely unfamiliar with the ocean) to marine invertebrates. The computer-interfaced physiology instrumentation vastly improves second- year students' opportunities to collect data that quantify the adaptive responses of animals to varying stimuli.

The importance of this instrumentation is that its use in undergraduate laboratory instruction provides more effective teaching of scientific methods for understanding the environment. A practical grasp of how scientific methods are used by investigators is important for both science and non-science majors, and environmental topics hold a special interest for this audience.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

YOUNG SCHOLARS

Frank C. Dukepoo	RCD 8850126
Northern Arizona University	FY88 $109,167
Flagstaff, AZ	Life Science

"Native American Young Scholars Summer Science Program"

This project provides an exhilarating summer science experience for 30 American Indian high school juniors from the Four Corners region of the Southwest.

The multidiscipline project includes life, physical and earth science, math and computer sciences, speech pathology and engineering. A variety of experiences include hands-on laboratory experiments, extensive personal interactions with research scientists, science seminars, field trips, and motivational and public speaking workshops. Students live and eat on campus, matriculate with other students and attend classes on career education, academic skills development and physical education.

In the second year, ten of the thirty students participate in an extensive research experience with select faculty members. These ten serve as role models and "big brothers" and "big sisters" to incoming new (30) participants.

TEACHER PREPARATION PROGRAM

Gordon P. Johnson	TPE 8652070
Raymond P. Tamppari	FY87 $430,754
Northern Arizona University	FY88 $134,414
Flagstaff, AZ	FY90 $142,475
	FY91 $147,990
	Other NEC

"Northern Arizona University's Science Learning Center Middle School Teacher Preparation Project"

Northern Arizona University will develop a five-year model for the preparation of middle school science and mathematics teachers. The proposed effort will involve the teaching of strong content courses in the development of a series of courses, referred to as "integrated laboratories", that attempt to help students tie the science and mathematics content to the realities of the middle school curriculum. The focus throughout the program is on integrating the mathematics and science and helping students to apply the formal content to the middle school.

The proposed program represents a coordinated effort involving scientists and mathematicians, science and mathematics educators, teacher educators, master teachers and school personnel. This program will prepare a teacher who has both content knowledge and skill with methods of teaching in the middle school. Numerous experiences with middle school children are planned. A capstone experience, following student teaching, is a summer "camp" in which students teach middle school children full-time under the guidance of master teachers and university personnel. Part of the evaluation of the project is to compare the content knowledge and teaching performance of teachers in this program with a matched control group.

TEACHER ENHANCEMENT PROGRAM

Thomas G. Potter	TPE 8652434
Tucson Unified School District	FY87 $144,747
Tucson, AZ	Phys Science

"Inservice Training of Intermediate School Teachers in Physical Science Education Using Collaborative Teams of Master Teachers"

This teacher enhancement project seeks to improve physical science education of students in the intermediate grades (3-6) of the Tucson Unified School District by increasing the physical science background of 142 intermediate school teachers. The project will also provide knowledge of, and experience with, instructional methodologies for teaching science to elementary students, especially activity based science instruction.

College scientists and science educators will work with three four-member teams, each including one HS chemistry teacher, one HS physics teacher, a middle school teacher and an elementary science specialist in an 11 day summer workshop. During these workshops the team members will enhance their science backgrounds and prepare materials for the inservice program which they will deliver to the intermediate teachers during two duplicate workshops of 14 sessions each during the academic year. One member of each team, the middle school teacher, will provide follow-up support to the intermediate teachers as they implement the program in their classrooms. Principals will also participate in an inservice program which will enable them to provide support and leadership for the science program in their schools. The ESS science materials will be focal ingredients of both the inservice program and the science teaching in grades 3-6.

The project involves a unique collaboration of college and university scientists and science educators, local industrial scientists and school district teachers and supervisors from all levels. The vita of the staff indicate that they are well qualified in terms of both background and experience to carry out the project successfully. The Tucson Unified School District is committed to the project as evidenced by a considerable amount of cost-sharing. The project will be evaluated utilizing both internal and external evaluators.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Stephen S. Willoughby	MDR 8651629
University of Arizona	FY86 $356.442
Tucson, AZ	FY87 $235.500
	FY88 $140.111
	FY89 $154.720
	Mathematics

"K-6 Supplementary Mathematics Materials for a Technological Society"

Perhaps the most important changes that ought to be made in traditional mathematics textbooks in order to prepare learners for a technological world have to do with the way mathematical concepts are taught in the first place, how they are practiced, and the kinds of applications that are presented. Many of these changes are not dependent on the use of calculators and computers, and some are currently finding their way into commercial textbooks. Others, which depend on activities in which calculators and computers play an important role, are slower to appear significantly in commercial texts because of the unlikely commercial success of a text series that requires access to calculators and computers throughout. This project will focus on materials that model changes of the latter type.

The project will develop supplementary mathematics materials for grades K-6 that will assume universal access to calculators and easy access to computers in the classroom. The materials will encourage problem solving, mathematical thinking, and intelligent use of technology. The final product will be a series of pamphlets (teacher materials and student materials) that can be used with any existing K-6 mathematics textbooks. A bibliography of appropriate calculator and computer books, software, and other materials will be provided in the pamphlets and referred to where appropriate.

ARKANSAS

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Rudolf H. Timmerman
Science
Newark High School
Newark, AR

Shari Wilson
Mathematics
North Pulaski High School
Jacksonville, AR

1988

Gary C. Miller
Mathematics
Pocahontas High School
Pocahontas, AR

Kathryn A. Roberts
Science
Lakeside High School
Hot Springs National Park, AR

COLLEGE SCIENCE INSTRUMENTATION

Bert E. Holmes	USE 8750879
Roberta M. Bustin	FY87 $25,057
Arkansas College	Chemistry
Batesville, AR	

"Infrared Spectrophotometry in Undergraduate Chemistry Instruction"

The use of a Fourier Transform Infrared (FTIR) Spectrometer with Data Station has recently been integrated into the undergraduate chemistry curriculum of the Chemistry Department at Arkansas College. The instrument is used in Instrumental Chemistry to teach instrumental operation, techniques of sample preparation, and Fourier Transform principles together with spectral interpretation and structure identification. In several courses in organic chemistry, the FTIR is used to characterize products, to indicate product purity, to elucidate structures and determine unknowns. Its uses in Physical Chemistry include the study of vibrational and rotational spectra and the investigation of isotope effects.

COLLEGE SCIENCE INSTRUMENTATION

Archie G. Lambert	USE 8851291
Arkansas Tech University	FY88 $53,238
Russellville, AR	Electrical Eng

"Sixteen Bit Digital Systems Laboratory"

This project supports the expansion of this institution's digital design laboratory to include sixteen-bit computer architecture. Using this laboratory, undergraduates write programs in high-level, assembly and machine languages, they experiment with serial and parallel communications and interrupts, and, they synthesize and monitor control programs for motors, robots and other devices. The equipment that supports this laboratory includes: in-circuit emulators, INTEL SDK-86 computers, PC-based development systems and associated software.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Nasser Rashidnia	USE 8750103
Arkansas Tech University	FY87 $30,656
Russellville, AR	Mechanical Eng

"An Undergraduate Thermofluids Measurement and Analysis Laboratory"

Modern measurement and analysis equipment will be used to upgrade an existing thermofluids laboratory under this project. The three areas to be covered include fluid flow anemometry, pressure measurement, and temperature measurement. In each of these areas, modern sensors will be obtained and interfaced with microcomputers. These include hot wire and film anemometers, pressure transducers, total, static and boundary layer pressure probe sensors, and temperature transducers. With this equipment, a variety of experiments will be performed including fluid flow velocity, dynamic and static pressure, aerodynamic drag, and heat and mass transfer with temperature distributions in flow fields.

COLLEGE SCIENCE INSTRUMENTATION

Charles W. Leming	USE 8851244
Henderson State University	FY88 $ 7,500
Arkadelphia, AR	Physics

"Computational Methods in the Undergraduate Physics Curriculum: An Integrated Approach"

This project supports the purchase of four microcomputer-based color graphics workstations, a laser printer, and associated software. This equipment will be used to improve instruction by integrating computational methods and computer graphics into the undergraduate curriculum in physics. These techniques and capabilities then will be applied to problems in classical mechanics, modern physics, and quantum mechanics.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Thomas E. Goodwin USE 8750417
Hendrix College FY87 $8,589
Conway, AR Chemistry

"Acquisition of Infrared Spectrophotometers for Microscale Organic Laboratory"

In the current trend toward microscale organic laboratories, the recent acquisition of two infrared spectrophotometers by the Chemistry Department at Hendrix College provides students with routine use of this instrumentation as an integral characterization tool for most of the microscale experiments. Additional instructional use is provided in Instrumental Analysis and senior Independent Study. The Department is continuing to develop new environmentally-safer experiments for the microscale laboratory, as well as to develop novel methods for the implementation of established experiments. This acquisition is assisting in the achievement of two general departmental objectives: (1) the introduction of modern instrumentation as a routine tool in introductory chemistry laboratories, and (2) the development of pedagogical models which may be useful to other institutions.

COLLEGE SCIENCE INSTRUMENTATION

Peter J. Pella USE 8750232
Hendrix College FY87 $7,250
Conway, AR Physics

"High Resolution Gamma Spectroscopy and X-ray Fluorescence for the Advanced Undergraduate Laboratory"

The Department of Physics will purchase a hyper-pure, intrinsic germanium detector and a MCA-card for an IBM-PC. The equipment will be used to strengthen the department's advanced laboratory program by introducing experiments in neutron activation, X-ray fluorescence and environmental studies.

TEACHER ENHANCEMENT PROGRAM

Margaret J. Guccione TPE 8652447
Robert G. Stephens FY87 $141,579
University of Arkansas Earth Science
Fayetteville, AR

"Field Skills and Activities Development for Earth Science Teachers"

Though geology is primarily a field science and the most effective method of study is in the field, most earth science teachers have little if any such experience. This program is designed to help teachers develop field skills and to provide them supplies, resource materials, and field activities that can be utilized in their earth science classes in Arkansas and Missouri.

The program will consist of two segments. The first portion will introduce earth science teachers to as much diverse geology as possible to develop their field skills. The course will begin at the University of Arkansas and Missouri campuses with a three-day intensive review and an introduction to the geology of the field area, Lander, Wyoming. In Wyoming the participants will work in field projects, and a resource unit on a field topic in geology.

The second portion of the program will occur in Arkansas and Missouri and involve the teachers in applying the skills learned in field camp to develop resource materials and field activities for their earth science classes. These reports will be edited and printed as a field guide to the geology of the state.

COLLEGE SCIENCE INSTRUMENTATION

Maurice G. Kleve USE 8851981
University of Arkansas Little Rock FY88 $43,384
Little Rock, AR Biology

"Image Analysis and Microscopy for Undergraduate Biology"

This project improves the cell and molecular biology curriculum by providing equipment to (1) develop a hands-on, instrument-based course in Microscopy; (2) improve the quality and effectiveness of laboratories in existing courses in Cell Biology, Developmental Biology, Immunology, and Biological Methods and Instrumentation; and (3) add current technology in microscopy to the available options in the department's undergraduate research program.

The equipment includes three high quality light microscopes equipped with optics and accessories designed for multiple applications of brightfield, phase, polarizing and epi-fluorescence, and a state-of-the-art image processing and analysis system. These new microscopes (along with two existing transmission and x-ray analytical scanning electron microscopes) will be interfaced by film and video with the image processor. The integrated imaging system will be applied in "bench-type" laboratory courses to real experimental situations. This instrument-intensive approach allows students to gain the experience required to operate modern equipment and the critical thinking and appreciation required to design modern experiments. It is expected to produce graduates who are better equipped for and more likely to undertake post-graduate studies.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Ahand K. Ojha USE 8852178
University of Arkansas Little Rock FY88 $24,300
Little Rock, AR Electrical Eng

"Modernization of Electronic Communication Laboratory"

To meet the growing demand of the communications industry, this institution has developed an emphasis on digital and fiber optic communication in the undergraduate curriculum of the Electronics Technology Program. This project provides six substations for experiments in data and fiber optic communication, and telephone networking techniques. The major equipment acquired under this project include six sets of fiber optic measurement systems, six digital communication experiment boards, two computer-controlled telephone exchanges, and two Zenith, Z-248 personal computers. The availability of this equipment allows the electronics technology students to reinforce theoretical concepts with hands-on laboratory experience in digital and fiber optic communication, and telephone networking technology.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Hirak C. Patangia USE 8750732
University of Arkansas Little Rock FY87 $50,000
Little Rock, AR Electrical Eng

"A Modern Undergraduate Engineering Technology Measurement Laboratory"

A novel undergraduate engineering technology measurements laboratory is planned. Recognizing that self-contained instruments such as oscilloscopes and signal generators are covered early in the curriculum, it will emphasize computer controlled test instrumentation, especially in-circuit testing using bed of nails instrumentation. Other areas that will be covered include the measurement of voltage, current and power with complex waveforms such as periodically switched voltages. This will be accomplished using digitized oscilloscopes and computer analysis. Another area which will be covered is device modeling through impedance analyzer measurements.

COLLEGE SCIENCE INSTRUMENTATION

Jerome E. Young USE 8851143
Wayne Poniewaz FY88 $10,690
University of Arkansas Monticello Social Science
Monticello, AR

"Acquisition of Behavioral Science Laboratory Equipment"

Computers, ancillary equipment and software are provided to establish a behavioral science computer laboratory for courses in political science, psychology, and sociology in the Department of Social and Behavioral Sciences. The laboratory provides social science majors, nonscience majors, and future secondary school teachers with hands on experience in the use of microcomputers and exposure to the scientific and technical aspects of the social sciences. Ten microcomputers and associated hardware, disc drives monitors, and four printers, are provided. Software includes a statistical package, data sets covering a wide range of topics in domestic and foreign affairs, and experiments designed for interactive student use. Students apply behavioral science concepts and methodologies to real data sets, become familiar with contemporary statistical packages, manipulate variables in relation to classic experiments, and design their own research projects.

COLLEGE SCIENCE INSTRUMENTATION

Jerald M. Manion USE 8851649
University of Central Arkansas FY88 $34,100
Conway, AR Chemistry

"Upgrading of Spectroscopic Techniques in the Undergraduate Curriculum"

The undergraduate instruction for chemistry majors is being upgraded and the curriculum modified. The new curriculum is introducing new laboratory courses in the instruction of advanced theoretical topics and laboratory techniques within the department. The two laboratory courses are making extensive use of NMR spectroscopy; one is an intermediate level course in Organic Spectroscopy and the other is a senior laboratory for chemistry majors. In addition, the department is adding experiments utilizing variable temperature NMR and decoupling in these and other courses within the curriculum. The department purchased a Varian EM360L Nuclear Magnetic Resonance Spectrometer equipped with an EM3630 Decoupling Accessory and an EM3640 Variable Temperature Accessory for use in accomplishing these goals.

The grantee is matching the award from non-Federal sources.

CALIFORNIA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Paul Robinson
Science
Edison Computech High School
Fresno, CA

Ronald E. Smith
Mathematics
Bishop Union High School
Bishop, CA

1988

Harold R. Jacobs
Mathematics
Ulysses S Grant High School
Van Nuys, CA

Wilton Wong
Science
Jefferson High School
Daly City, CA

RESEARCH IN TEACHING AND LEARNING

Robert A. Weisgerber	MDR 8751195
American Institutes For Research	FY88 $159,968
Palo Alto, CA	FY89 $140,020
	Other NEC

"Research to Identify Critical Factors Contributing to Entry and Advancement in Science, Mathematics, and Engineering Fields by Disabled Persons"

The involvement of disabled persons in science education is critical to the Nation's scientific enterprise. The potential of this minority has begun to be recognized, however the actual level of participation remains low.

This project seeks to bring into focus the factors influencing the successful entry of disabled persons into the fields of science, mathematics, and engineering. The Critical Incident technique will be used to gather data on "barriers" to working in the sciences and how these barriers were overcome from 150 disabled working scientists and from 150 disabled college students. This information will be used to develop booklets of two types: career decision and "making it" booklets for pre-college students, and an Achiever's book (profiles of disabled scientists who can be used as role models) for secondary and post-secondary students. American Institutes for Research will collaborate with the American Association for the Advancement of Science (as subcontractor) in carrying out this research on a national basis. AAAS will participate in the selection of sample, analysis of data, and in the development and dissemination of materials. The proposed research is challenging and will provide needed information to a critical minority group.

COLLEGE SCIENCE INSTRUMENTATION

Danny White	USE 8851710
American River College	FY88 $38,464
Sacramento, CA	Chemistry

"Computer-Directed Experiments for Freshman Chemistry Laboratories"

Freshman chemistry students are being prepared for transfer to four year institutions and for careers in industry by doing laboratory experiments using computer directed equipment. This is happening by upgrading Chemnet (Chemistry CAI) with more powerful computers and printers that have more capabilities and chemical applications for handling and manipulating data. The freshman students are learning to store data on text files, carry the text files to Chemnet, and transfer the files into Chemnet for data evaluation, printing and plotting. Students are also using a computer to control the variables of the experiment and the UV-Visible spectrophotometer and then transfer the data electronically with Chemnet. The students are also using the computers with other accessories to learn additional laboratory techniques.

The grantee is matching the award from non-Federal funds.

COLLEGE SCIENCE INSTRUMENTATION

Ray M. Ward	USE 8852544
Bakersfield College	FY88 $12,380
Bakersfield, CA	Chemistry

"Improvement of Spectrophotometric Experiments in General and Organic Chemistry"

The number of available Spectronic 20 spectrophotometers in General Chemistry is being increased from two to twelve units. This is allowing all students in a full laboratory section to perform experiments requiring extensive measurements from these instruments. The new instruments are allowing the curriculum to include experiments which establish the formula of complex ions, rates of dissociation of complexes, kinetic rate laws for the bromination of acetone, and other appropriate quantitative experiments. A second infrared spectrophotometer is also being added. This is allowing the organic laboratory students to increase their routine analysis of starting materials and synthesis products. It is also facilitating the introduction of infrared analysis into the general chemistry laboratory sections which are currently too large to be served by a single instruments. An example of a new experiment, which has been added is a study of the bonding in ligands of a cobalt (III) complex.

The grantee is matching the award from non-Federal sources.

PRIVATE SECTOR PARTNERSHIPS

John H. Chase	TPE 8851121
Judith Gerhart	FY88 $177,038
Kay Michaels	FY89 $226,020
Business Labor Council of Ventura County	Biology
Ventura, CA	

"Science and Mathematics Improvement Project"

The Business Labor Council of Ventura County, an organization formed in 1982 under the authority of the State of California, will work with county schools, local community colleges, and local businesses to enhance science and mathematics education programs for non-college-bound students. The county schools, which have substantial minority enrollments, find these students have little understanding of how mathematics and science courses will help prepare them for the job market and avoid these courses even if they do not drop out before graduation. Local businesses will work with teachers, guidance counselors, and high school classes in a variety of ways to enhance the understanding of local job opportunities for non- baccalaureate youth and the prerequisites for acquiring and succeeding in such jobs. Included in the program will be joint activities with local community colleges to integrate high school and community college curricula leading to locally needed associate degrees. Students with aptitude for baccalaureate programs will be encouraged to enter those, but the primary emphasis will be on routes to good career opportunities not requiring a baccalaureate degree.

Cost sharing by the other partners will equal 100% of the NSF funding.

INFORMAL SCIENCE EDUCATION

Peter U. Rodda	MDR 8550957
California Academy of Sciences	FY86 $149,830
San Francisco, CA	FY87 $285,780
	Geology

"Life Through Time -- The Impact of Evolution"

The California Academy of Sciences, a major natural history institution located in San Francisco, will develop Life Through Time, a large permanent exhibition on evolution that will inform and challenge visitors as they "walk through" a series of exhibits which encourages them to touch and explore.

The exhibition will cover the history of life on earth, how scientists recognize and evaluate change through time, the scientific method and process of discovering, and the impact of evolution. A teacher's educational resource kit with hands-on materials will be developed for use in the schools along with teacher training courses.

The exhibition will reach a substantial audience, over a million and a half visitors per year. Additionally, 44% of the San Francisco elementary school children are visited each year by Academy docents, the mobile classroom reaches 7,000 Bay Area residents, over 5,000 children and adults take classes at the Academy and 10,000 school children visit the museum each year.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

David L. Goodstein	MDR 8652023
California Institute of Tech	FY87 $658,933
Pasadena, CA	FY88 $335,122
	Physics

"Adapting Beyond The Mechanical Universe: Materials for High School Physics"

The Mechanical Universe and Beyond The Mechanical Universe is a one-year college-level physics course for national television currently under development at Caltech and supported by a $5.8 million grant from the Annenberg/CPB Project. This project has three objectives: (1) to produce videotape adaptations and print materials based on Beyond The Mechanical Universe for use in high schools, (2) to conduct regional workshops on the use of the materials, and (3) to plan dissemination procedures for promoting the increased effective use of the materials by all teachers. The last objective will utilize results from two years of field testing and from related special projects.

The academic and television staff of the Caltech project will work closely with a group of outstanding high school teachers, the Materials Development Council, to continue the development of the materials. In addition, Council members will conduct regional workshops on the use of materials for teachers residing in their local areas. The videotapes and supportive written materials will be field tested by the Council members and by the teachers participating in the workshops. The results of the evaluation will be utilized to modify the materials. The project has undergone thorough evaluations, and staff have made effective use of the results in revising the materials. In addition to evaluation done to yield information for revisions, data was also gathered from teacher and student participants as to their reactions to the materials.

Over the past few years, staff of the project for Adapting The Mechanical Universe and Beyond has done impressive work. The series is of high quality and in demand by high school physics teachers. Thorough evaluation has led to effective revisions in both the teacher and student materials. In these times, when the importance of good science instruction at the precollege level is being seriously recognized, this project is making valuable contribution to high school physics education. The additional funds in FY88 will allow project staff to take a final look at the original 12 modules; and make revisions based upon special studies, reviews, and assessments of the final eight modules.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

David L. Goodstein	MDR 8751537
California Institute of Tech	FY88 $1,147,949
Pasadena, CA	Physics

"Adapting Beyond the Mechanical Universe: Modern Physics for High Schools"

The Mechanical Universe and Beyond the Mechanical Universe is a one-year college level physics course for national television that was developed at Caltech and supported by a $5.8 M grant from the Annenberg/CPB Project. For the past three years, the project staff which developed the undergraduate course has been adapting the videos for use at the high school level as well as providing written materials and teacher guides. To date, 12 modules have been adapted from The Mechanical Universe.

This project will select the most appropriate materials from Beyond the Mechanical Universe and adapt four modules for use at the high school level. The majority of physics concepts and topics treated at the secondary level will be covered. The four modules will be selected from the following programs: "The Lorentz Transformation", "Velocity and Time", "Optics", "The Atom", "Particles and Waves", "Atoms to Quarks", and "The Quantum Mechanical Universe".

The final selection of topics will be done by the project staff in conjunction with the Council on Development. The Council is composed of 12 outstanding high school teachers who will work during the summer of 1988 and field test the materials in their home schools during the 1988-1989 academic year. In addition to the Council, approximately 60 other teachers across the country are participating in the field testing and evaluation of the program.

This project is making a substantial contribution toward excellence in physics instruction. Each module stresses conceptual understanding of the underlying physical principles. The computer animation adds to the learning experience in way not possible in the past. The current materials have been well accepted by schools across the nation and evaluation reports underscore their effectiveness.

STUDIES AND ANALYSES

Jerome Pine	OSPA 8751511
California Institute of Tech	FY88 $163,016
Pasadena, CA	FY89 $158,370
	Studies

"Evaluation of Alternatives for Assessing Science Process Learning by Elementary School Children"

This study will explore alternative testing methods to meet the demands of the hands-on approach to science teaching. Because of the critical importance of early science education, the grantee will work with fifth grade students. The investigative technique will be observation of a hands-on scientific investigation, scored by scientists and science teachers. The investigation will compare four surrogates with this method: (1) computer simulation of a hands-on test, (2) hands-on test with written responses, (3) free response pencil and paper test, and (4) multiple choice test. The data may prove to be of great value in designing cost-effective, practical tests that closely approximate the expensive, logistically difficult, hands-on tests with scientists as observers.

INFORMAL SCIENCE EDUCATION

Eugene Harrison	MDR 8651997
Ilan Chabay	FY86 $190,600
California Museum Foundation	FY87 $111,406
Los Angeles, CA	Chemistry

"Concepts of Chemistry: A Hands-On Exhibition"

The California Museum of Science and Industry will create a 3,000 square foot permanent exhibition of hands-on participatory exhibits on chemistry and chemical phenomena that will allow visitors to manipulate the variables of chemical systems. Forty exhibit units will be organized in clusters in that represent the basic concepts of properties of atoms and molecules, molecular structure and chemical reactions, stability of molecules and rates of reactions, forces between atoms and molecules and energy of atoms and molecules.

The exhibition will use state-of-the-art technology to present chemical experiments previously left to the lab bench or the demonstration table. Interactive computers and videodiscs will be used where danger or complexity prevents the visitor from using "the real thing." Exhibit content will be proved in prototype form and tested on museum staff, visitors, and school groups prior to final design and construction. NSF support will be used in the design and prototype phases, and an "exhibit cookbook" of exhibit technologies for use by other museums will be created.

The project has already attracted more than $175,000 of matching funds towards a total of $800,000 in non-NSF matching funds.

COLLEGE SCIENCE INSTRUMENTATION

K. N. Balasubramanian USE 8851167
California Polytechnic St Univ SLO FY88 $18,400
San Luis Obispo, CA Mechanical Eng

"Development of A Pneumatic Automation Simulator"

A Pneumatic Automation Simulator is developed using pneumatic and electro-pneumatic elements in the Industrial Engineering Laboratory at this institution. The simulator is used primarily in the manufacturing oriented engineering courses. It provides practical instruction to students in the design, test, and microcomputer control of pneumatic circuits that generate several of the automation functions used in manufacturing methods and assembly systems. The most common functions in the circuit designs are work clamping, release and/or ejection, orientation, work sequencing and delay. This instructional facility also acts as an independent setup for student projects and attracts industry collaboration with the institution in the continuing education of their engineers in the use of pneumatic automation systems.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Raul J. Cano USE 8851335
California Polytechnic St Univ SLO FY88 $48,850
San Luis Obispo, CA Biology

"Laboratory Equipment for an Undergraduate Biotechnology Program"

The equipment obtained through this project is enabling this institution to provide an appropriate theoretical and practical background for students enrolling in a Biotechnology minor that addresses both the need for entry-level technicians in the growing field of biotechnology and the preparation of undergraduates who will go on to pursue advanced academic degrees.

The new minor includes three laboratory courses (Molecular Biology Laboratory, Tissue Culture Techniques, and Protein Laboratory Techniques) that are designed to give each student substantial amounts of "hands-on" experience in basic and specialized techniques in these areas. Grant funds are being used to purchase essential equipment of three types: (a) small equipment needed to equip four student stations (four students/station); (b) several intensive-use items such as HPLCs and laminar flow hoods; and (c) specialty equipment that will introduce undergraduates to "state-of- the-art" technology (e.g., a DNA synthesizer). Such equipment is providing for a smooth sequence of offerings, ranging from "special topic" experiences for only a few students to the complete courses with labs that are essential to creating a well defined curriculum.

This biotechnology program is regarded as having good potential for becoming a national model that can be replicated in other institutions.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

James G. Harris USE 8751395
California Polytechnic State Univ FY87 $52,206
San Luis Obispo, CA Electrical Eng

"Workshop on Undergraduate Education in Electrical Engineering"

In response to the National Science Board report and subsequent workshop, a workshop on undergraduate electrical engineering education was conducted in May 1987 in Kansas City. The discipline of electrical engineering is the largest engineering discipline in the United States. It is also the principal driving force behind many of the technological changes that are impacting science and engineering education. Thus, special attention is being given to electrical education curricula because of the discipline's impact on society through the human resources and technology produced. The purpose of the workshop was to identify the types of undergraduate curricula-related initiatives needed for electrical engineering and the best investigative models for addressing these initiatives. The workshop report was distributed to the 230 U.S. electrical engineering department heads and the results were disseminated at both the annual meeting of the American Society of Engineering Educators and the Frontiers in Education conferences.

COURSE AND CURRICULUM

James G. Harris USE 8854620
California Polytechnic St Univ SLO FY88 $80,000
San Luis Obispo, CA Engineering

"Use of Technology for Undergraduate Engineering Education"

The objective of this project is to apply technology created by engineers -- the engineering workstation interfaced to an interactive video disk -- for the improvement of undergraduate engineering education. A first step is to define a technology baseline consisting of an engineering workstation with peripherals, software specifications, user interface, and prototype instructional modules. This technology baseline will permit the consortium of four institutions to exchange modules and evaluate modules prepared by the other institutions.

The institutions have committed matching funds that are approximately one and one-half times the funds granted by NSF for this project.

This project is co-funded with the NSF Directorate for Engineering.

COLLEGE SCIENCE INSTRUMENTATION

Unny Menon USE 8750022
California Polytechnic State Univ FY87 $32,080
San Luis Obispo, CA Electrical Eng

"An Undergraduate, Robotics Application, Instructional Workcell"

A Technovate robotics instructional workcell will be installed in the multi-disciplinary center for computer-integrated manufacturing. It will enhance and broaden the scope of undergraduate instruction in robotics and enable new experiments in system integration and campus network interfacing. The workcell is particularly adaptable to electronics manufacturing applications and has the capability for off-line programming. The workcell includes an IBM 7535 industrial robot with Z-80 microprocessor, an IBM PC with AML/E robotics software for off line programming, and safety interlocks. The open systems architecture will allow experimentation linking the cell with an existing ZILOG development system.

COLLEGE SCIENCE INSTRUMENTATION

Norman H. Pillsbury USE 8851523
California Polytechnic St Univ SLO FY88 $50,000
San Luis Obispo, CA Biology

"An Integrated Natural Resources Management, Data Acquisition Analysis and Presentation System for Undergraduate Teaching"

This project is designed to provide Natural Resources Management students with a sequential program of computerized data collection, monitoring, analysis and presentation of synthesized resource and climatic information. Implementation of this program dramatically improves the Natural Resources Management curriculum by providing state-of-the-art computer equipment, and the opportunity for "hands-on" application of resource management principles with "real-time" analysis and interpretation.

Equipment being purchased through this project include geographic information system hardware (including a digitizer, a color terminal, and plotter), hand-held data logger computers, microcomputer workstations, and a computer projection system for classroom demonstration. This project is vital to the Natural Resources Management curriculum as it provides the opportunity for undergraduates to be exposed and to develop a working understanding of today's technology as currently used by professionals in both industry and government agencies.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Satwant S. Rihal USE 8750748
California Polytechnic State Univ FY87 $23,250
San Luis Obispo, CA Arch Eng

"Upgrading of Undergraduate Structural (Seismic) Testing Laboratories"

The undergraduate seismic laboratories will be improved with the addition of two model shaker stations. This will give architectural engineering students first hand experience in the use of modern seismic testing equipment to verify the fundamental concepts of structural behavior. The two shaker stations will be equipped with Acoustic Power Systems Electro-seis horizontal shakers, VIPAC vibration testing workstations for test control, data acquisition and processing and a Hewlett Packard spectrum analyzer and plotter. The stations will allow senior architectural engineering students to experimentally investigate not only fundamental dynamic properties and response of small-scale building structures but also the relationship between structural stiffness and corresponding natural frequencies.

COLLEGE SCIENCE INSTRUMENTATION

Daniel W. Walsh USE 8750170
California Polytechnic State Univ FY87 $50,000
San Luis Obispo, CA Materials Eng

"An Undergraduate Thermo-mechanical Test Laboratory"

Under this project, a Gleeble test facility will be constructed for undergraduate materials laboratory experiments. The facility will allow students to conduct experiments involving the dynamic thermal and mechanical stressing of materials, simulating the process stresses received during manufacture and use. In addition, basic property determinations will be made, including dilatometry deformation mapping, weld heat affected zone studies, sintering, solidification, heat treatment, precipitation kinetics, hot ductility, corrosion, and thermal fatigue and stress rupture. It is expected that this facility will provide a prototype undergraduate metallurgy and materials laboratory for the 1990's.

COLLEGE SCIENCE INSTRUMENTATION

Daniel W. Walsh USE 8853028
California Polytechnic St Univ SLO FY88 $100,000
San Luis Obispo, CA Material Eng

"Undergraduate Nondestructive Evaluation Facility"

This project expands this institution's already existing materials program to include state-of-the-art nondestructive evaluation of materials and manufactured components. The equipment incorporated into the lab includes: a scanning laser acoustic microscope, acoustic emission analysis system, image analysis system and eddy current test device. These computer interfaced devices are used to evaluate both metallic and non-metallic materials.

Students using the enhanced materials laboratory are able to experiment with: material identification, flaw detection, flaw size determination, semiconductor continuity, sintering efficiency, debonding of composites, fatigue crack propagation, martensitic transformations, weld flaw detection and characterization of hydrogen damage.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Michael T. Wollman USE 8852014
California Polytechnic St Univ SLO FY88 $45,903
San Luis Obispo, CA Electrical Eng

"Advanced Electro-Optics Laboratory"

This project introduces undergraduates to some advanced topics in fiber optics. The fiber optics laboratory supported by this grant builds on an already existing laboratory that was funded by industry. The enhanced laboratory permits students to study modern optical fibers and connection techniques. A new course, supported by this laboratory, permits students to investigate optical signal processing techniques and components.

The primary equipment that supports this laboratory includes: laser diode drivers, HP pulse and function generators, fiber optic receivers and power supplies, electro-optic modulator with driver, and a collection of lasers and equipment accessories.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

D.Stafford Woolard USE 8851511
California Polytechnic St Univ SLO FY88 $14,605
San Luis Obispo, CA Civil Eng

"Environmental Experimentation Laboratory"

This project permits undergraduate students to experiment with the effects of variations in heat, sound and light on human senses. This experience prepares these students to incorporate environmental concepts into the building design process. The equipment used to support this project includes: temperature sensors, thermal monitoring system, thermographs, thermohygrographs, heat pump demonstrator, photometer and a light demonstration box along with a microcomputer and environmental software.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

William A. Stannard TPE 8652002
California State College Bakersfield FY87 $112,746
Bakersfield, CA Mathematics

"Improvement of Mathematics Instruction at the Grade 5-9 Level in Kern, Inyo, and Mono Counties"

This project addresses the expressed needs of local teachers of mathematics at the Grades 5-9 level in an area of California where opportunities for enhancing their teaching skills and content updating are not readily available. The program is set up to run during the spring, winter and summer semesters at times that were indicated as being preferable by the teachers who were polled for this information. A second level local effort has been constructed to guarantee that the concepts identified and learned in these courses get to other teachers and students. Two to four teachers per school comprise a "team" from each of fifteen participating schools for a total of 45 participants. These teachers will act as "mentor teachers" for their colleagues. Instruction for these mentor teachers will include leadership strategies as well as discipline course content. Two Cooperating Teachers, chosen by the first group of participants, will work along with their colleagues in their schools. The follow-up program at each school, subsidized by the Teacher Education and Computer (TEC) Centers and the school districts, centers on participant-given workshops for their peers. Project instructional staff will attend and provide resources for these workshops. Mentor teachers will conduct at least two workshops and work closely with their two Cooperating teachers.

Credit will be awarded for participation in this program, and women and minority applicants who will be good role models for their colleagues and students will be identified and selected. An Advisory Council made up of two participants, one staff member and one school administrator will provide on-going feedback and information to the Project Director, faculty and participants.

Dr. Stannard has thirty-three years of experience with Mathematics Education which includes Directorship and Co-Directorship of eight NSF grants in Mathematics and/or Computer Education. He has assembled a very impressive staff for this project. This project has the potential of impacting on a substantial number of schools in a rural area of California whose teachers have expressed strong needs in mathematics.

COLLEGE SCIENCE INSTRUMENTATION

Ralph J. Charkins USE 8853029
California State Coll San Bernardino FY88 $36,970
San Bernardino, CA Economics

"A Computer-Based Undergraduate Economics Curriculum"

Economics is a difficult subject to learn. Undergraduates often fail to grasp the fundamental concepts and relationships of the discipline and seldom develop the basic skills of economic analysis. The three major reasons for this are the mathematical nature of the discipline, the perceived abstract nature of the subject, and the level of statistical sophistication necessary to perform even fairly simple analysis.

This project exploits the educational capabilities of the microcomputer to minimize these obstacles. Software and data bases tailored to the level of sophistication of the students are used in a twenty one workstation laboratory purchased by this award for the introductory courses, four specialized upper-division courses, and, in the future, the bulk of the remaining upper division courses. In addition, an entirely new course has been developed using the work stations. Drill and practice are avoided, and economics skills are developed throughout the entire undergraduate economics curriculum.

The award will be matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Robert S. Cunningham USE 8852038
California State College Stanislaus FY88 $47,858
Turlock, CA Computer Science

"A Workstation Environment for Computer Science"

This project enhances the upper level computer science offerings at this institution by providing students with high-efficiency work stations and specialized programming tools. The laboratory that supports this project includes networked SUN workstations and such software as Franz Extended Common Lisp, Smalltalk, MProlog, Ada and expert systems tools. Using this laboratory, students are exposed to some practical programming projects that would not be possible using conventional microcomputers.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Jill P. Adler TPE 8751211
Donald F. Hoyt FY87 $397,213
Scott E. Pattison Biology
Pamela J. Sperry
Cal State Polytechnic Univ Pomona
Pomona, CA

"Cellular and Molecular Biology in the High School Classroom: A Laboratory-Oriented Approach"

This 3-year program is designed to provide 64 high school biology teachers with the confidence and expertise needed to implement an experimental approach in their classroom teaching. In conjunction with school district personnel and university faculty, some of these teachers will also help develop an In-Service Training Program for other high school biology teachers which emphasizes use of a discovery/experimental approach in the classroom.

During the first two years, each teacher (32/year) will develop a research project in collaboration with a university faculty member of the CA Poly Institute for Cellular and Molecular Biology (ICMB). The independent research project will be done during four weeks of the summer and the results presented at a symposium. Teachers will also participate in a week of intensive laboratory exercise workshops in which they will gain hands-on experience with student exercises which emphasize the discovery approach, quantification of results, and new techniques for teaching cellular and molecular biology. Teachers will have the opportunity during the summer to expand their expertise in computer-aided instruction and to acquire background and updated information in various areas of cellular and molecular biology through seminars and workshops, and the monthly ICMB Journal Clubs. They will also learn about and gain experience with modern techniques and instrumentation through their research projects, the lab exercise workshops and an electron microscopy seminar.

To help implement the scientific method in the high school classroom, weekly group sessions during the summer and academic-year workshops will be organized to discuss various methods of incorporating this approach in the classroom. The teachers will maintain a teaching diary to help them monitor their individual progress in achieving this objective. University Institute for Cellular and

Molecular Biology faculty will visit the classrooms of their high school faculty partners to encourage them to make these changes. During the third summer, six of the participants, school district science education personnel (4-6) and the ICMB Board will develop an In-Service Training Program designed to help other teachers use an exploration/inquiry approach in their classrooms. The project directors will visit school districts to promote the use of the In-Service Training Program.

COLLEGE SCIENCE INSTRUMENTATION

David P. Campbell USE 8852997
Cal State Polytechnic Univ Pomona FY88 $13,578
Pomona, CA Computer Science

"Extended SEM Capabilities for Undergraduate Science Instruction Through Microcomputer Interfacing"

This project provides students in Electron Microscopy and Computer Science exposure to the use of microcomputers and array processors as a modern means of data collection and mathematical manipulation of data in the context of image processing. The use of a microcomputer interfaced to the scanning electron microscope (SEM) extends the instructional capabilities of the instrument and exposes the students to computers in new scientific applications. Microcomputers interfaced to a computer with an array processor allow the use of fast fourier transform (FFT) processing of images obtained from the SEM. Student instruction is enhanced by the extended capabilities of the instrument: increased resolution, improved signal-to-noise ratio, and operation at low beam currents.

The grantee provides funds for this project that are an equal match for the NSF award.

TEACHER ENHANCEMENT PROGRAM

George W. Martinek TPE 8651683
Cal State Polytechnic Univ Pomona FY87 $355,113
Pomona, CA FY88 $ 27,977
Other NEC

"Comfortable Approach to Teaching Science (CATS)"

This project, Comfortable Approach to Teaching Science (CATS), is designed to increase the comfort levels of elementary teachers with science and technology topics in a five-week residential setting followed by an academic year program which will include weekend retreats and networking and technology update conferences. Fifty-seven teachers and twenty-eight school administrators from Southern California will participate in the workshop each year during the two-year project. Program goals include: (1) strengthening of the science content background and teaching strategies of selected elementary teachers, (2) strengthening the background of elementary administrators, and (3) enhancing the background of participants by devoting time to teaching modalities for minority children with language difficulties and non-traditional learning styles.

COLLEGE SCIENCE INSTRUMENTATION

Steven W. McCauley USE 8750530
Cal State Polytechnic Univ Pomona FY87 $34,172
Pomona, CA Physics

"Modern Optics and Spectroscopy for Undergraduates"

Modern optics is an area of increasing importance to the economy. The Physics Department at Cal Poly Pomona will enhance their program in optics and spectroscopy by purchasing a nitrogen-pumped dye laser and nanosecond resolution detection system. This laser system will be used in the optics class to teach students principles of laser operation and to provide a source for non-linear optical effects. The laser system will also serve as a resource for the Physics majors in the advanced laboratory series in order to enable students to do advanced experiments and research projects in optical pumping, resonance transfer of energy in optical systems, non-linear optics, the measurement of fluorescence lifetimes, Raman spectroscopy, thermal lensing experiments, and photochemistry. The short pulse duration, high power, and variable wavelength of the dye laser will make it a versatile and reliable light source for undergraduate optics at all levels.

TEACHER PREPARATION PROGRAM

Francis P. Collea TPE 8751179
California State University FY87 $76,394
& Colleges System FY88 $76,866
Long Beach, CA FY89 $82,463
Geology

"Urban Science Transition to Teaching Project"

Demographic studies show a severe shortage of qualified mathematics and science teachers throughout the United States. At the same time there are relatively untapped pools of prospective teachers, particularly among scientifically competent individuals, who will make a career change at mid-life either because they wish to do so or because their employment must be terminated. This project will develop an innovative and important model for the preparation of science teachers for middle school teaching, especially in urban areas where the need is great. The California State University System has already begun such a program in San Francisco. Under this grant the program will be improved and evaluated. The programmatic model will also be moved to one or two California State institutions in the Los Angeles area.

The mid-life prospective teachers will receive single subject credentials for middle school teaching in California. Their programs will involve varying amounts of cooperation from former employers and from urban school districts. Some will undergo most of the program while still employed by their long-term employer. The various forms of the program model will be carefully evaluated.

Highly competent and professional science and mathematics teachers are especially needed in the middle grades (5-9). It is during these years that students form important and fundamental attitudes toward mathematics and science and skills in those fields that strongly influence subsequent careers and literacy. Unfortunately, many middle school students receive very poor experiences in math and science and negative attitudes develop early that influence many individuals throughout their entire lives. This is especially true for urban children whose culture, language, and failure orientation are special barriers to growth and development in science. This project is one attempt to respond to these very important needs.

COLLEGE SCIENCE INSTRUMENTATION

Ralph Gagnon	USE 8750147
California State University Chico	FY87 $29,950
Chico, CA	Electrical Eng

"An Undergraduate Optical Electromagnetic Wave Laboratory"

A laboratory to demonstrate electromagnetic wave principles in the optical region is being developed primarily for a second course in Electromagnetics and a new course in Fourier Optics. The electromagnetics course focuses on wave phenomena, and optical wavelengths are giving the students practical experience and applications. In addition to a light valve projector, the appropriate optical breadboard equipment, including lasers, tables, illumination systems and positions are being purchased. Using the system, the principles of birefringence, polarization, illumination, interferometry, optical Fourier transforms, light valves, and conventional optics are being demonstrated.

COLLEGE SCIENCE INSTRUMENTATION

William D. Korte	USE 8750218
California State University Chico	FY87 $13,515
Chico, CA	Chemistry

"Liquid Chromatography in Undergraduate Chemistry Instruction"

The addition of an autosampler and fraction collector to existing units has produced a modular microprocessor controlled liquid chromatography (LC) system for the Chemistry Department at California State University, Chico. The added components facilitate the use of the system for large undergraduate classes by automating time consuming separations and semi-preparative purifications and sample collection. The entire system is being used for the experimental enhancement of four chemistry classes, and for undergraduate independent study projects. Five new experiments, using LC technology are being developed for the undergraduate laboratories.

COLLEGE SCIENCE INSTRUMENTATION

Riadh Munjy	USE 8852157
California State University Fresno	FY88 $51,000
Fresno, CA	Civil Eng

"Computer Aided Mapping"

This project permits surveying engineering students to have a laboratory experience of applying photogrammetric methods to computer aided mapping and geographic information systems. The project laboratory includes a fast, versatile computer aided analytical stereoplotter. With this equipment, students experiment with stereo models and with generating and manipulating digital terrain data bases. In combination with other existing equipment, advanced students monitor structural deformations, measure underwater structures and analyze human body and joint movements for bioengineering studies.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

J.Dario Aristizabal-Ochoa	USE 8852994
D. V. Ramsamooj	FY88 $10,544
California State University Fullerton	Civil Eng
Fullerton, CA	

"Enhanced Earthquake Simulator"

This project upgrades an already existing laboratory for earthquake study. The laboratory improvement includes the addition of a controller that adds the capability of simulating a real earthquake on a shaking table. The improvement of the earthquake lab permits students to study structures and their behavior under real earthquake conditions. The major piece of equipment supported by this award is an MTS Systems 469.11 three variable controller.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Richard A. McFarland USE 8851875
California State University Fullerton FY88 $23,308
Fullerton, CA Psychology

"Improvement of Instrumentation and Instructional Format in Physiological Psychology"

This project provides five physiological recording instruments for 120 students per semester in six laboratory sections of a course in Physiological Psychology. The study of the physiological bases of behavior requires accurate monitoring and recording of physiological responses. The equipment provided for this project allows the upper division undergraduate students to gain the necessary hands on experience to grasp the relationship between biology and behavior and to understand the techniques by which these relationships are discovered. When not needed for the Physiological Psychology classes, the equipment is employed in demonstrations in the Introductory Psychology classes and Research Methods classes. In addition, the equipment significantly increases the quantity and quality of independent research projects carried out by undergraduate students doing research in Physiological Psychology.

The award will be matched by an equal amount from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Glenn M. Nagel USE 8853024
California State University Fullerton FY88 $15,738
Fullerton, CA Biology

"Modern Electrophoresis and Immunochemistry Equipment for Undergraduate Laboratories"

This project is providing electrophoretic and immunochemistry equipment for use by undergraduate students enrolled in the Biochemistry and Molecular Biology courses. The equipment is being used to educate students in both the theory and the practice of modern techniques used to separate and analyze proteins and nucleic acids from biological sources. The new instrumentation includes a video densitometer, an ELISA reader,eight electrophoresis set-ups, computer interfaces and software.

A sound set of educational and scientific goals is being pursued systematically under this project. The approach being employed stresses the quantitative uses of electrophoretic and immunochemical methods for detecting molecules (using modern densitometry and absorbance measurements), along with more traditional approaches. Under the resulting program students now are receiving the hands-on laboratory experience necessary to prepare them for scientific careers in biotechnology, the health professions, industry, and research.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Joyce K. Ono USE 8750586
California State University Fullerton FY87 $43,082
Fullerton, CA Biology

"Equipment for Neurobiological Experiments and Computerized Data Acquisition/Analysis in an Undergraduate Physiology Program"

During the past 10 years, Neuroscience has coalesced from Pharmacology, Physiology and Biopsychology into a coherent discipline which occupies a prominent position in Biology. This project integrates neurobiological experiments into current physiology courses through the purchase of extracellular recording devices which can be used to add two modern, sophisticated neurobiology experiments to the Mammalian Physiology laboratory and to initiate the laboratory portion of a new Neurobiology course. Computer-interfaced data acquisition and analysis apparatus is being used with the above units and in 11 of 13 existing experiments in Mammalian Physiology, as well as in various experiments in Neurobiology, Cell Physiology and Comparative Physiology. The addition of these two experimental setups and the experiments they make possible enable students to become familiar with some of the modern, sophisticated neurobiological and computer-oriented techniques used in research and industrial laboratories where graduates may pursue advanced studies or career employment.

TEACHER ENHANCEMENT PROGRAM

David L. Pagni TPE 8651992
California State University FY87 $104,449
  Fullerton FY88 $188,798
Fullerton, CA Mathematics

"Santa Ana - Fullerton Elementary Mathematics Project (SAFEMAP)"

This project will use the new California Framework for Mathematics as a model to merge the content and methodology needs into an inservice package for 66 elementary teachers in the Santa Ana Unified School District and the Diocese of Orange.

The project has two goals: (1) Identify and support ethnic minority school children who have mathematics potential. (2) Help teachers of grades K-6 improve their skills in mathematics content and mathematics teaching. The project represents a university's partnership with a school district and parochial diocese that have school populations that are over 75% Hispanic, an ethnic group that is underrepresented in professions requiring mathematics and scientific preparation. There is evidence that at the elementary school level, Latino children show promise of success in these areas, but this is not fulfilled at the high school or college level. The project seeks to improve this discrepancy by identifying children who show mathematical promise, involving parents through a home-school linkage, and training teachers to develop children's mathematical potential.

This project addresses a major priority of the Division of Teacher Preparation and Enhancement to extend opportunities in mathematics to all students. The instructional team of four have expertise in content and experiences in teaching and bilingual/bicultural education to meet these needs.

INSTRUCTIONAL MATERIALS DEVELOPMENT

David L. Pagni	MDR 8651616
Robert Y. Hamada	FY86 $461.497
California State University Fullerton	FY88 $351.044
Fullerton, CA	Mathematics

"Calculators and Mathematics Project - Los Angeles (CAMP-LA)"

The electronic hand-held calculator is a tool that can be used as an integral part of the elementary school mathematics curriculum. With calculators so abundant and inexpensive, each child should be able to have a calculator for appropriate use in mathematics and in other subjects where mathematics can be applied. Although some materials are available that support the use of the calculator in the elementary school, there exists currently no coherent set of materials that looks at the curriculum in a new light, assuming that the calculator is an essential tool to be used in learning and doing mathematics.

This project will develop a model for change in the K-6 mathematics curriculum, based on the assumption that every child has a calculator. Anticipated changes include diminishing time spent on certain topics (such as long division) and increasing time spent on other topics (such as problem solving and reasoning). The project will develop a set of calculator-based student materials for Grades K-6 designed to be flexible enough to stand alone or be supplementary; a set of teacher materials that will include a guide for teaching mathematics using calculators and student evaluation materials with protocols for evaluating student work when engaged in activities such as problem solving; and materials on the use of calculators in an elementary setting, to be used in the preservice preparation of teachers.

The project will be a collaborative effort of the California State University at Fulleraton and the Los Angeles Unified School District. One of the goals of the project is to create a replicable model for university-school district cooperation in curriculum development and teacher education.

COLLEGE SCIENCE INSTRUMENTATION

Christopher L. Kitting	USE 8750588
California State University Hayward	FY87 $13.422
Hayward, CA	Biology

"Portable Equipment for Teaching Undergraduate Biology Students to Conduct Digital Video Analyses along Environmental Gradients"

A transportable image analysis computer system is being used for the objective acquisition, analysis, and presentation of diverse imagery data collected in the field and laboratory. Primary goals in the extensive undergraduate field projects supported through this award are to illustrate limitations on population distributions; students thus uncover major limits at opposite boundaries in zonation along environmental gradients. Nearby marshes on San Francisco Bay provide gradients between marine, aquatic, and terrestrial environments, both natural and disturbed.

One such set of quantitative experimental field ecology studies is providing students with valuable insights into field experimentation through high-resolution, time-lapse monitoring of transplant experiments. Students are comparing the fates of plants (and of sedentary animals) that have been moved experimentally beyond their normal zones, with the fates of replaced individuals. These studies strikingly illustrate the selection pressures that operate when an organism attempts to invade a new habitat. Such modern field experimental approaches are preparing students to make practical, technical, and logical applications of science in their personal lives and, for some, in environmental careers.

COLLEGE SCIENCE INSTRUMENTATION

Michael S. Belsley	USE 8851582
California State University Long Beach	FY88 $25.887
Long Beach, CA	Physics

"Creating an Undergraduate Modern Optics Laboratory in Lasers and Laser Spectroscopy"

The Physics Department will create a student laboratory which will introduce undergraduates to fundamental concepts and current research techniques in the field of modern optics. In the first half of the course, students will build up a basic working knowledge of the principles of lasers by constructing both a pulsed dye laser and a continuous wave helium-neon laser cavity. In the second half of the course, students are given the opportunity to carry out detailed experiments, concentrating on a specific area in modern optics. Initially three topics, acousto-optic modulation, molecular spectroscopy, and holography/optical information processing will be offered. Subsequently, additional topics such as fiber optics and nonlinear crystal optics are to be developed.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Jeffrey A. Cohlberg USE 8750821
Margaret L. Merryfield FY87 $38,778
Roger Acey Chemistry
California State Univ Long Beach
Long Beach, CA

"Instrumentation for a Newly Revised Undergraduate Biochemistry Laboratory Course"

A new curriculum for a one-semester biochemistry laboratory course has been designed and is being implemented by the Chemistry Department at California State University at Long Beach. The course is the capstone of a newly approved degree program leading to a Bachelor of Science in Biochemistry. The course emphasizes the acquisition of both experience with modern biochemical research techniques and instrumentation and the acquisition of problem-solving skills used in a research setting. The following equipment has been recently added to the department's instrumental holdings, specifically for use in this regard: a high speed centrifuge, three ultraviolet-visible scanning spectrophotometers, a high pressure liquid chromatography gradient system with variable wavelength detector, and three low pressure liquid chromatography systems. In addition to experiments on protein determination, enzyme kinetics, and gel electrophoresis, the isolation and characterization of hemoglobin, DNA, and messenger RNA, from the brine shrimp Artemia Salina, is carried out, together with experiments on the transformation of bacteria with recombinant plasmids and the isolation and characterization of the plasmids.

COLLEGE SCIENCE INSTRUMENTATION

Murray D. Dailey USE 8750058
California State Univ Long Beach FY87 $23,053
Long Beach, CA Environmental

"Hydrowinch and Automated Probe Sampling System for an Undergraduate Ocean Studies Laboratory Aboard a Six Campus Consortium Vessel"

A multi-channeled, electromagnetic cable winch with automated multi-parameter probe sensors will be used by undergraduate students from six southern California state universities aboard the Southern California Ocean Studies Consortium teaching vessel. With this winch and instrumentation the laboratory exercises will expose students to the application of current principles and analytical techniques. The equipment makes possible a continuity in the laboratory exercises by eliminating the need to return to the home campus for data analyses. This provides the students with a much needed "hands on" experience with automated instrumentation. This type of experience with this equipment in the "at sea" laboratory enhances the preparation of prospective graduates for future professional work.

COLLEGE SCIENCE INSTRUMENTATION

Roswitha B. Grannell USE 8750776
California State Univ Long Beach FY87 $38,704
Long Beach, CA Geology

"Implementation of Field-Oriented Projects into the Senior Level Undergraduate Geophysics Curriculum"

California State University, Long Beach, will purchase a seismograph with tape drive and falling-weight source, and supporting computing facilities to allow completion of two field projects (one each semester) in the senior level geophysics sequence. In the introductory geophysics (first semester), the equipment will be combined with departmental holdings in gravimetry, magnetics and electrical resistivity to conduct an engineering geophysics project, to help identify recently active traces of the San Andreas fault near Mecca Hills, California. In petroleum geophysics (second semester), the laboratory will use seismic reflection studies, combined with gravity and magnetic work, to characterize the subsurface geology in a producing oil field near Coalinga, California. In both cases, students will help plan the project from available literature, collect, reduce, and interpret data, and do some geological field work to facilitate interpretation. Specific reduction techniques have been chosen to supplement lecture and laboratory sessions A final comprehensive report will be written by each student for each project.

YOUNG SCHOLARS

William C. Ritz RCD 8850192
California State Univ Long Beach FY88 $70,109
Long Beach, CA FY89 $70,109
Ocean Science

"Young Scholars Ocean Science Institute"

The Science and Mathematics Education Institute of California State University, Long Beach involves 30 students in grades 9-10 in a 2-part program focusing on ocean science. In the program, ocean science serves as a vehicle for addressing all the sciences and selected aspects of engineering. Phase I provides 3 1/2 weeks in residence on the CSULB campus, followed by a 3-day field excursion on Catalina Island. During the summer, students also study how science operates, culminating in a research project which continues into the subsequent school year. A key feature of this phase places each student at the side of a working scientist or engineer, to devote at least one day "shadowing the scientist". Team teaching involves scientists from the university, industry and Jr./Sr. High School teachers.

In the follow-up phase during the subsequent school year, students continue their research within a network which provides a variety of support services. Six Saturday follow-up sessions enable students to continue their exploration of a broad variety of science and engineering possibilities, as well as nurture their continuing research.

COLLEGE SCIENCE INSTRUMENTATION

Anjan K. Bhaumik USE 8851914
California State Univ Los Angeles FY88 $30,550
Los Angeles, CA Civil Eng

"Universal Testing Machine for Materials Testing Laboratory"

This project introduces computer assisted testing of materials into the Civil and Mechanical Engineering curricula at this institution. The laboratory that supports this project includes a Tinius Olsen Universal Testing Machine with an integrated microcomputer. This equipment not only permits students to carry on many experiments in a given lab period, but, because of the automated data acquisition and display capabilities of the equipment, students gain a greater intuitive feel for the behavior of materials.

This award is being matched by an equal sum from the grantee.

CAREER ACCESS OPPORTUNITIES

Theodore J. Crovello USE 8850613
Margaret C. Jefferson FY88 $104,733
David Stoloff FY89 $100,000
Richard Alvidrez
California State University Los Angeles
Los Angeles, CA

"The Southern California Access Center and Network"

This prototype project includes several activities to strengthen minority education from the early grades through the baccalaureate degree. It was developed under the leadership of California State University-Los Angeles, with cooperation from other California State University institutions in the Los Angeles Basin, the Los Angeles School System, and business and industry. During the first year of operation, a set of activities, based on science and mathematics experiences, and designed to nurture, encourage and motivate minority students, are being implemented. These include a Minority Math/Science Program, a retention activity focussed at the undergraduate level, which is patterned after a successful, ongoing Minority Engineering Program established earlier in the region. Critical elements of this program include academic support, tutoring, personal counseling, a student study center, summer job placement assistance, and participation in student organizations. At the precollege level, a Saturday Science Project for elementary school students and teachers is being offered. Science Skills Centers which offer enriched classroom experiences for students and provide a setting for undertaking improvements in junior high mathematics are being established. In addition, a Summer Science Institute is being conducted in which curriculum development activities occur, through joint efforts by university and precollege faculty.

COLLEGE SCIENCE INSTRUMENTATION

Phillip I. Gold USE 8851329
California State Univ Los Angeles FY88 $11,317
Los Angeles, CA Mechanical Eng

"A Cogeneration Instrumentation Laboratory"

This project permits undergraduate mechanical engineering students to carry on experiments on a small-scale cogeneration system that is instrumented and interfaced to a data acquisition system. Student experiments and projects involve both thermodynamic and economic evaluation of cogeneration concepts. They also learn about techniques of computer assisted data acquisition in a laboratory environment.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Young C. Kim USE 8750146
California State Univ Los Angeles FY87 $12,880
Los Angeles, CA Civil Eng

"An Undergraduate Coastal Hydraulics Laboratory Wave Generating Channel"

This project is to construct a wave generating channel for the undergraduate fluids laboratory in coastal hydraulics. It will provide the students equipment to study wave mechanics, kinematics, and wave transformation. The channel will be used in courses covering coastal hydraulics and coastal engineering.

COLLEGE SCIENCE INSTRUMENTATION

Eduardo M. Ochoa USE 8750397
California State Univ Los Angeles FY87 $50,000
Los Angeles, CA Economics

"Economics and Statistics Microcomputer Laboratory"

This project would fund a micro computer classroom/laboratory dedicated to economics, statistics and quantitative methods, class support and student research. The economics and statistics department currently relies on the campus mainframe computers (Cyber) and standard academic software (Minitab, SPSS) for course projects in business statistics and uses programs written by faculty for pedagogical support in economic theory courses. This environment is not easy for undergraduates to deal with and is not typical of the situation they will work in after graduation. Further, the quantitative and statistical software being developed for business today is designed for the stand alone desktop environment. Micro computers will be significantly more "user friendly" and will permit the faculty to concentrate their instruction on the theory and techniques of the subject matter without having to teach the student how to use the computer.

COLLEGE SCIENCE INSTRUMENTATION

Sandra B. Sharp USE 8750387
California State Univ Los Angeles FY87 $49,421
Los Angeles, CA Biology

"Gene Manipulation: A Practical Undergraduate Education in the Theory, Methods, and Potential of Biotechnology"

With the equipment (centrifuges, incubation equipment, specialized storage apparatus, a DNA photodocumentation system, water purification equipment and electrophoresis apparatus) secured through this project, this Biology Department is expanding its course offerings in Molecular Biology to include a core of four courses to deal with biotechnology at various levels. Two of these provide intensive experience with practical genetic manipulation procedures in a student genetic engineering laboratory.

Recent advances in the technology of gene manipulation have created a booming new industry, an extraordinarily powerful research tool, and promises for novel solutions to medical, environmental, and agricultural/industrial problems. A broad spectrum of undergraduates have a need for education in the new molecular biology. Those who plan to continue in research-oriented higher degree programs will profit greatly from having practical knowledge and laboratory skills that will equip them to apply modern molecular genetic approaches to research problems. Students terminating their formal education at the B.S.-level can be immediately employable in the biotechnology industry or in one of the many research laboratories employing techniques of gene manipulation.

Pre-professional students can be prepared better to understand and appreciate diagnostic and therapeutic techniques stemming from the new biotechnology and to appreciate its potential for the future practice of medicine.

COLLEGE SCIENCE INSTRUMENTATION

P. K. Subramanian USE 8852276
California State Univ Los Angeles FY88 $50,449
Los Angeles, CA Mathematics

"Microcomputer Laboratory Facility to Upgrade the Teaching of Undergraduate Numerical Analysis and Related Courses"

The Department of Mathematics and Computer Science will establish a microcomputer laboratory for advanced undergraduate courses. The computational nature of the Numerical Analysis, Numerical Calculus, and Linear Programming courses will be revised and Applied Linear Algebra will be added to the curriculum. Two- thirds of the student body are minorities.

The laboratory will consist of 30 computers with access to all campus computers, video projector and printing stations.

The grantee is providing an equal sum obtained from non-Federal sources.

CAREER ACCESS OPPORTUNITIES

Victor H. Galloway USE 8850656
Steven Ray FY88 $91,000
California State University Northridge Other NEC
Northridge, CA

"Career Access Opportunities in Science and Technology for Deaf Students"

This model project was developed by the National Center on Deafness at the grantee institution. During the first year, learning experiences are being provided for elementary, junior high and senior high students to stimulate their interest in science and technology by providing deaf students with enhanced access to existing programs through the provision of interpreting services. The emphasis on existing programs is to minimize redundancy while providing deaf students with access to mainstream programs. Plans for the second year and beyond will focus on reducing the attrition among deaf students at the postsecondary level. This will be accomplished by providing more intensive interpreting, notetaking and tutorial services for deaf students. Additional services, provided in the form of specialized training for interpreters, will be made available to regional junior colleges. This will facilitate access to science and technology for deaf students on those campuses.

TEACHER ENHANCEMENT PROGRAM

Steven B. Oppenheimer	TPE 8650081
California State Univ Northridge	FY86 $121,057
Northridge, CA	FY87 $113,765
	FY88 $137,547
	FY89 $24,000
	Biology

"Advances in Biological Science"

This project will provide professional development for 120 outstanding junior and senior high school science teachers. The teachers will learn concepts and laboratory methods associated with contemporary research at the frontiers of biology, and they will prepare appropriate lesson plans and laboratory activities for secondary school students. The biologists making the presentations have been chosen on the basis of research skills and award-winning teaching. A feature of the program will be a keynote address and visit with Nobel Laureate Francis Crick, co-discoverer of DNA. The program staff also includes science educators from the local school district and from higher education.

This project will address topics at the frontiers of nutrition, marine biology, genetic engineering and recombinant DNA technology, human ecology, cancer biology, electron microscopy, cell biology, developmental biology, and computer applications in biological research. The laboratory program will stress methods and materials in modern cell biology.

Products of the project will include a book, video tapes, and laboratory activities that are both relevant and appropriate for secondary school students. It is anticipated that these products will be sponsored in part by local corporations or organizations. Another anticipated project outcome will be the initiation of courses or extracurricular activities in selected secondary schools that stimulate and support students conducting independent research projects.

COLLEGE SCIENCE INSTRUMENTATION

Joan Al-Kazily	USE 8851278
Cal State University Sacramento	FY88 $6,650
Sacramento, CA	Civil Eng

"Traffic Data Acquisition and Analysis Laboratory"

This project supports the enhancement of the teaching of Transportation Engineering at this institution. Computers are integrated into two undergraduate courses covering transportation facility design and operation and transportation systems planning and management. The project makes electronic data acquisition equipment and data analysis software available to undergraduate students for use in class assignments and projects. The equipment made available for this project includes traffic counting equipment and software, turning movement counter, and in-motion data collection system.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

James G. Simes	USE 8851141
Cal State University Sacramento	FY88 $50,000
Sacramento, CA	Electrical Eng

"General Purpose Instrumentation Bus Laboratory"

This project provides eight (8) General Purpose Instrumentation Bus (GPIB) equipped laboratory stations for undergraduate students in this institution's electrical and electronics engineering program. The stations are used in the first junior-level circuits lab and the first junior-level electronics lab. Each station consists of a triple power supply, a function generator, a digital voltmeter, an oscilloscope, a multiplexing switch, a GPIB controller and a printer. This laboratory configuration permits major revisions in the curriculum impacted by the lab, revisions that take advantage of the changes in technology represented by this lab setup.

This award is being matched by an equal sum from the grantee.

PRIVATE SECTOR PARTNERSHIPS

Mary Poplin	TPE 8851067
Claremont Graduate School	FY88 $70,000
Claremont, CA	FY89 $91,492
	Other NEC

"Southern California Science and Mathematics Education Collaborative"

The Claremont Science and Mathematics Collaborative, a partnership of the Claremont Graduate School, local industrial leaders, expert pre-college science and mathematics teachers, and area school districts, will develop and operate a program to facilitate mid-career moves into teaching by industry scientists and engineers. With the cooperation of their managements, experienced technical graduates in industry who are interested in entering science and mathematics teaching will be recruited into a special program of the Claremont Teacher Education Internship Program. Here they will initially spend one summer in on-campus courses and orientation at Claremont, then one year in a school teaching full time with the support and guidance of a master-teacher mentor, and then one more summer on campus. They can then be certified for teaching in California, and with an additional eight credits they can receive a Master of Arts in Teaching degree. Transition financial support for the participants will be provided by their industrial employers, the Claremont Graduate School, and the National Science Foundation. Industry support will be developed and coordinated by the Technology Exchange Center, an existing organization of local industry, education, and government leaders.

Cost sharing by the partners will total 60% of the NSF funding.

PRIVATE SECTOR PARTNERSHIPS

Mariana V. Latham	TPE 8851090
Cupertino Union School District	FY88 $69,537
Cupertino, CA	Mathematics

"Mathematics in Everyday Life"

The Cupertino (CA) Union School District, in partnership with the Cupertino Chamber of Commerce and volunteer accountants, stockbrokers, and bankers, will develop a mathematics program -- "Mathematics in Everyday Life" -- for 4-6th grade students.

The program will utilize the expertise of the volunteer accountants, bankers, and stockbrokers in the local community to work with teachers to develop lessons for the classroom which provide practical math applications and real life skills to students. Two new units -- "Project Bookkeeping" and "Project Stockmarket" -- will be developed to complement "Project Banking", a previously developed unit which will also be revised as dictated by classroom experience. Completed materials will be made available for use throughout the Cupertino district and information about the program will be disseminated through county education offices and the State Chamber of Commerce.

Cost sharing by the school district and private sector people and organizations will equal 70% of the NSF funding.

INFORMAL SCIENCE EDUCATION

Thomas G. Musca	MDR 8652300
Ramon Menendez	FY87 $162,019
Kate Long	FY88 $ 10,000
East Side Productions	Mathematics
Santa Monica, CA	

"Walking on Water": A Presentation of the PBS American Playhouse Series"

This project, WALKING ON WATER, chronicles the success of Jaime Escalante's nationally acclaimed mathematics program at Garfield High School in Los Angeles. Overcoming crime, poverty and a 50% drop-out rate, Mr. Escalante transformed Hispanic students with deficient scholastic backgrounds into the top calculus students in the country. As a result of this success, Garfield High School is now a magnet school for math and science in the Los Angeles School District.

Mr. Escalante's story will be told in a 90 minute film docudrama which will air nationally on public television's American Playhouse series, the 14th most popular program on PBS reaching 1.2 million homes. The film is designed for general theatrical release, for educational distribution on cable, for videocassette release and will be dubbed in Spanish for airing in Spanish theaters. In addition, Eddie Olmas, the Emmy award winning star of Miami Vice who portrays Mr. Escalanate in the film, will use the film in personal appearances

Additional funds are recommended to develop an outreach program with Hispanic organization nationwide.

COLLEGE SCIENCE INSTRUMENTATION

James C. Eckert	USE 8852804
Harvey Mudd College	FY88 $17,228
Claremont, CA	Physics

"Undergraduate Laboratory on the Measurement of Temperature Dependent Properties of Materials"

One of the best methods for studying the underlying mechanisms associated with the properties of a material is to make measurements of the temperature dependence of intrinsic properties of the material. This fact has been brought home forcefully in reviewing the work currently in progress on the new high Tc superconductors. Despite the importance of understanding the significance of such measurements and the techniques involved in making them, many students have had very little opportunity for laboratory exposure in this area. In this project two systems for the measurement of temperature dependent properties will be developed for use in the upper and lower level student laboratories. The systems will include two Hansen High-Tran Liquid Transfer Systems, for sample cooling and temperature control, and two Hewlett Packard 150 series personal computer systems for data acquisition and real-time analysis. The new equipment will be used in the sophomore-level modern physics laboratory to make measurements of transport properties that can be explained in terms of a simple free-electron model, in the senior-level advanced laboratory to investigate the properties of superconductors, quasi-low dimensional conductors and other novel materials, and also in individual student research projects.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Michael A. Erlinger	USE 8750727
Harvey Mudd College	FY87 $50,000
Claremont, CA	Computer Science

"Parallel Processing System for Undergraduate Instruction"

The objective of this project is to set up a parallel processing facility in support of courses in concurrent processing. The core of the proposed system is a Sequent Balance 8000 computer with eight processors, eight megabytes of memory and an ethernet interface. The parallel processor will be used in several computer science courses and student design projects.

COLLEGE SCIENCE INSTRUMENTATION

Richard C. Haskell	USE 8750246
Harvey Mudd College	FY87 $15,873
Claremont, CA	Physics

"Introduction of Computer-Aided Data Acquisition and Analysis in Advanced Undergraduate Physics Instructional Laboratories"

Computers have revolutionized experimental methods in physics, yet physics students have not had the equipment to use computers for data acquisition and analysis. The Physics Department at Harvey Mudd will integrate computer systems into three laboratory experiments. The first experiment is in Fourier transform spectroscopy: it requires extensive computation using the fast Fourier transform algorithm. The second is a photon statistics experiment, which requires the acquisition and analysis of large quantities of data. The third is an atomic spectroscopy experiment which relies upon computer-aided data acquisition to eliminate systematic drifts while increasing the signal-to-noise ratio. All three experiments depend critically on the judicious use of computers. In order to equip these experiments, three DEC LSI-11/2 microcomputers will be ungraded by the addition of hardware and software for data acquisition and for communications to provide access to the Harvey Mudd College central network of VAX computers. In addition, the department will purchase a stepping motor to complete a Fourier transform spectrometer and photon counting accessories. The new equipment will be used in a junior-level optics laboratory, a senior-level advanced laboratory, and in individual student research projects.

COLLEGE SCIENCE INSTRUMENTATION

Gerald R. Van Hecke	USE 8851387
Harvey Mudd College	FY88 $53,217
Claremont, CA	Chemistry

"A Multi-Functional Laser Laboratory for Undergraduate Chemistry"

A central multi-functional laser laboratory is being created. The laboratory is allowing the unique capabilities of laser light sources and computer-assisted data acquisition and analysis to be realized by undergraduate students. The facility is providing the means to augment the teaching of classical thermodynamics, integrating the teaching of molecular spectroscopy across three years of study and providing an opportunity for experimentation in kinetic studies. Specifically the laboratory consists of two laser light sources (an argon laser and a nitrogen-pumped dye laser), associated optics, a monochromator, sample holders, a detection system, and a microcomputer for experiment control and data analysis. The equipment is mounted on a common optical table to allow for the modular design of experiments which share a common source or detector, providing an economy of scale. The system allows novel measurements of physical and chemical properties in ways which more clearly elucidate these properties as well as illustrate the power of modern optical techniques. In addition, students' experience with computer control and interfacing is being significantly enhanced. It is planned to describe the successful projects in the literature to provide impact beyond the local facility.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Rose E. Ehret	TPE 8751526
Holy Names College	FY87 $216,297
Oakland, CA	FY88 $202,831
	Mathematics

"Mathematics In-Service for Oakland Teachers"

This two-year project serves the middle and high school mathematics teachers in Oakland, California. Four-week summer workshops, organized around the California Mathematics Framework and the district's adoption of new textbook series, enhance the participants' problem-solving skills, knowledge of mathematics, and familiarity with teaching strategies. Academic-year activities include follow-up workshops and visits to the participants' classes.

The first year of this college and public school collaborative will provide an intense four-week summer institute and monthly academic year follow-up for 90 junior and senior high school (7-12) mathematics teachers of the Oakland Public Schools in California. The second year is designed for 90 middle school (5-8) Oakland teachers. At least sixty percent of the teachers will be minorities. The plan is to assist the teachers upgrade and deepen their mathematical knowledge, beyond the materials of the new text book adoptions. The content for the first year will range from pre-algebra to pre-calculus, with geometry a requirement for all teachers. In addition, effective teaching methods, assessment materials, and classroom procedures will be explored.

The project is now in its second year. The first year's activities were targeted at teachers of grades 7-12, and the second year's at those of grades 5-8.

RESEARCH IN TEACHING AND LEARNING

Roy D. Pea	MDR 8855582
Institute for Research on Learning	FY88 $325,996
Palo Alto, CA	FY89 $327,792
	Physics

"Cognitive Processes in Understanding and Using Scientific Diagrams"

Cognitive research indicates that science experts commonly use diagrams as mediational tools for reasoning visually. But in science education materials and practices, visuals are typically "aids" rather than fundamental representations. This research will examine how students learn to comprehend, use, and construct diagrams as thinking tools. It will focus on the diagram-dense field of beginning optics. The project has two interacting phases: research on how students understand static optics diagrams, and development and refinement of prototype computer- based dynamic diagrams and diagramming tools. Specific tasks are: (1) Pilot research, and analysis of diagrams in optics texts, (2) research on instructional practices with these diagrams, (3) research on student understanding and use of diagrams, (4) the design and development of interactive diagrams and a dynamic diagram-construction kit, (5) research with prototypes, and (6) creation and dissemination of interactive diagrams in science education. Such research on visual education in science will help guide development of new curricula and software for science education. The project team of cognitive scientists, science educators, graphics specialists, and systems developers is devoted to promoting learning and reasoning in science with new data, theory, and innovative prototypes of dynamic diagrams. These interdisciplinary activities link science education research, materials development, and classroom activities. Cost sharing is provided by the Institute for Research on Learning, which is contributing indirect costs, and APPLE, which is contributing four MacIntosh II systems.

TEACHER ENHANCEMENT PROGRAM

Hector Timourian	TPE 8651988
Lawrence Livermore Laboratory	FY87 $280,470
Livermore, CA	Elem Science

"Helping Our Partners Enrich Science (HOPES): A Partnership in Elementary Science Inservice Training"

This proposal will utilize the expertise of 30-50 local science professionals (Content Specialists) and 150 elementary school teachers in a four-week inservice training partnership. The workshop will benefit from the strength and uniqueness derived from the active participation of two science-rich communities. One is the greater Livermore, California area, that includes 5000 practicing scientists, technologists and engineers. The other community is the "Space Coast" area of Brevard County, Florida, where the science resources are even greater than those of Livermore.

The aim of "Helping Our Partners Enrich Science" (HOPES) is to bring a high quality science program into the elementary classroom and is based on a proven pilot program. HOPES summer workshop will include content training, topic selection, lesson development, mentor teachers development, follow-up activities and the development of a manual. The program will involve scientists and teachers working together in the learning, teaching and sharing of basic skills, strategies, methodologies and content information for effective teaching of science.

The staff for both locations of this project is highly qualified. In addition to the college level personnel, two master teachers are included on the instructional staff. The combined team represents a broad range of experience in science and science education.

HOPES should provide a highly refined and well documented program for teacher inservice training in science and for training scientists and engineers as classroom resources. This program has the potential to become a model which can be replicated in many other science-rich communities throughout the country.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Roberta M. Jaffe	MDR 8751833
Gary W. Apple	FY88 $454,854
Life Lab Science Program Inc	FY89 $502,696
Capitola, CA	FY90 $646,461
	FY91 $650,676
	Life Sciences

"Life Lab Science Program: Development of a Comprehensive Experiential Elementary Science Curriculum"

This is a broad expansion of a program that has had ten years of successful piloting and tryouts throughout the country, particularly in California. It had some previous National Science Foundation and U. S. Department of Education funding.

This garden-based program for grades K-6 will expand the proposers' current life science program into a comprehensive elementary science program. It offers an explicit plan to involve students in a substantial number of good, hands-on experiences. The materials for hands-on work are familiar to most teachers and, in terms of their quantities and cost, are both affordable and manageable.

The Life Lab Science Program integrates conceptual learning and practical applications to demonstrate to students how science relates to everyday life. They learn, for example, how their bodies, like plants, need nutrients that are available from various sources. This learning is gained through chemical experiments with, and data analysis of, nutrients in soil. A variety of learnings are derived from this work, including some that relate to ecology, ethical issues, and decision-making.

Addison-Wesley Publishing Company will provide strong staff and financial support ($2.4M). This support assures potential for broad use of this program in our schools.

INFORMAL SCIENCE EDUCATION

Camm C. Swift	MDR 8751868
Judith Chovan	FY88 $181,512
Jeffrey Seigal	Ocean Biology
James Olson	
Los Angeles County Museum of Natural History	
Los Angeles, CA	

"A National Traveling Exhibition on the Biology of Sharks"

The Los Angeles County Museum of Natural History will design, construct and circulate a 3,000 square foot travelling natural history exhibition on the biology of sharks to 15 museums and more than 1,000,000 visitors nationwide. The exhibition will include mounted specimens, artifacts, models and replicas, and interactive exhibition elements. It will provide visitors with a picture of the undersea world of sharks, their diversity and abundance; with an understanding of the basic biology of sharks, including sharks' differences from bony fish, their fossil and current natural history, reproduction, and behavior; and with an appreciation of the interaction between sharks and humans in history, in myth, and in man's current intensive use of ocean environments.

A teacher's guide and school loan study kits of objects and artifacts will be available in each museum location. Substantial prior analysis of visitor misconceptions about sharks has been done, and formative evaluation will be used to select exhibit components and interactive technologies. Cost sharing amounts to 52% of the project total.

PRIVATE SECTOR PARTNERSHIPS

Patricia C. Dung	TPE 8851081
Los Angeles Educational Partnership	FY88 $128,170
Los Angeles, CA	FY89 $271,820
	Other NEC

"Target Science"

Target Science is a project designed to develop a replicable model for revitalizing the teaching of K-12 science in highly impacted urban schools.

The goals of Target Science are to (1) provide replicable methods for science teachers and their private sector, university, and community partners to collaboratively identify needs for improving instructional delivery, and then develop strategies that will successfully respond to these needs, and (2) provide replicable methods to channel science-rich community resources to science teachers in a manner that will facilitate and stimulate positive and enduring change in the delivery of K-12 science instruction.

Target Science is designed to meet these goals by creating a model that (1) builds an environment to nurture and stimulate change (K-12 Service Dialogues, Science Forums, and Family Science Workshops), (2) establishes methods for improving science teacher knowledge bases and instructional delivery techniques (Mini-grants, Science Center Grants, Professional Development Grants, K-12 Science Workshops and IISME) and (3) enhances communications in general and information exchange in particular (TELEventure).

Cost sharing by the partners will total 738% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Franklin E. Fisher	USE 8750454
Loyola Marymount University	FY87 $43,000
Los Angeles, CA	Mechanical Eng

"An Undergraduate Materials Science/Metallurgy Laboratory"

The undergraduate materials science and metallurgy laboratory will be upgraded with modern equipment. In addition, the emphasis in the laboratory will be changed from qualitative to quantitative measurements. Improved will be the present experiments in deformation hardening, alloying effects, heat treatment, recrystallization, precipitation hardening, and martensitic strengthening. With the new equipment, five new experiments will be added covering time, temperature, transformation curves, stress-strain characteristics, solid solution hardening, multiphase eutectic structures and general metallography. These new experiments will use instruments such as nanovoltmeters and electrometers, micro- and regular hardness testers, and optical microscopes.

INFORMAL SCIENCE EDUCATION

Lenore Blum	MDR 8751452
Mills College	FY88 $66,778
Oakland, CA	Mathematics

"An Interactive Video Project to Enhance the Value of Educational Television"

Dr. Lenore Blum and associates at Mills College plan to explore the use of an interactive videodisc environment for elementary education in mathematics using existing materials from SQUARE ONE TV. The project will use a prototype interactive computer learning system that uses icons embedded within an exploratory environment to allow learners to select their own activities. The system allows videodisc materials to be easily combined within an interactive computer environment and includes browsing, lesson selection, open exploration, practice problems, and extended activities keyed to the SQUARE ONE TV material.

They will produce a videodisc with source materials provided by Children's Television Workshop, design the inte/ractive environment, and evaluate its effectiveness with trial groups of teachers, students, and others in formal and informal settings. This modest proposal will extend the range of utilization of SQUARE ONE TV and provide valuable information on its potential use in non-broadcast settings.

A supplement was added to allow the project staff to utilize the services of a noted mathematics education consultant to strengthen the software design of their Square One TV research videodisc.

TEACHER PREPARATION PROGRAM

Jane Bowyer	TPE 8751487
Mills College	FY87 $177,878
Oakland, CA	FY89 $120,000
	FY90 $ 85,000
	HS Sci/Math

"Midcareer Mathematics and Science Teacher Preparation Program (MCMS)"

This three-year teacher preparation project will develop and evaluate a model for recruiting and preparing midcareer persons to teach secondary school science and mathematics. Mills College and the Lawrence Hall of Science (University of California, Berkeley) faculties will address the issues of the critical shortage of well-qualified secondary science and mathematics teachers through an innovative two-year graduate Midcareer Mathematics and Science Program (MCMS).

The aims of the program are to: (1) attract midcareer persons with strong academic and applied backgrounds in mathematics and science; (2) develop model content update and methods courses for the midcareer population; (3) implement a preservice teacher education program specifically tailored to these midcareer candidates. The new model courses will emphasize recent developments and applications in the fields of mathematics, physics, chemistry, and biology and their relationships to the high school curriculum; the integration of concepts within and across fields; and hands-on, interactive teaching strategies developed in subject-specific methods classes and in school-based experiences. Course development, implementation of the model program, and evaluation of program effects will lead to a self-sufficient component of the Mills College credential program, to technical reports of program development and effect, and to instructional materials which can be implemented at other sites.

COLLEGE SCIENCE INSTRUMENTATION

Clinton D. Harper	USE 8852053
Moorpark College	FY88 $19,024
Moorpark, CA	Physics

"Development of a Modern Physics Laboratory for Lower-Division Undergraduate Students"

This project proposes to begin the first phase of the development of a modern physics laboratory facility for freshman and sophomore science majors. Students principally affected will be majors in physics, engineering, mathematics, electro-optics and the biological sciences.

The equipment proposed for purchase consists of six student gamma ray multi-channel analyzer stations. Each station, which typically will accommodate two students, has an IBM compatible Intel 80286 based microcomputer and plotter interfaced with a multi-channel analyzer board. A scintillation detector and amplifier detects gamma radiation from a number of sources, enabling the students to perform experiments in which isotopes are identified, absorption coefficients are measured and half-lifes determined. The microcomputers purchased under this proposal will also be used to interface with other experiments in the laboratory and to run related software packages.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Eleanor D. Siebert USE 8750280
Mount St Mary's College FY87 $17,101
Los Angeles, CA Chemistry

"Updating Instrumentation in the Natural Sciences"

New scientific instruments have been recently acquired by the Physical Sciences and Mathematics Department at Mount St. Mary's College. These include an ultraviolet-visible spectrophotometer, a gas chromatograph (GC) with a micro preparative assembly, a high performance liquid chromatograph (HPLC), and an atomic absorption (AA) spectrometer. This instrumentation is being used to update the curriculum in the undergraduate laboratories by providing students hands-on experience with analytical techniques where lecture presentations have often sufficed in the past. A major curriculum component being developed is that involving the role of the computer in data acquisition and treatment, with important applications in Instrumental Analysis as well as in the Physical and Honors General Chemistry laboratory courses.

COLLEGE SCIENCE INSTRUMENTATION

David G. Pelka USE 8750242
Northrop University FY87 $50,000
Los Angeles, CA Electrical Eng

"Creating an Undergraduate Electro-optics Laboratory at Northrop University"

This project is to set up a new electro-optics laboratory, a field that is emerging as one of the critical areas of telecommunications. Instrumentation such as monochrometers, low power lasers, pyroelectric radiometers and fiber optics communications links will be integrated into an undergraduate laboratory. New experiments are to be developed which will strengthen undergraduate education in the fields of lasers, fiber optics communications, electro-optical instruments and holography.

COLLEGE SCIENCE INSTRUMENTATION

C. David West USE 8851689
Occidental College FY88 $31,228
Los Angeles, CA Chemistry

"GC-MS for Undergraduate"

A Gas Chromatograph-Mass Spectrometer is being added to the undergraduate laboratories. The instrument is being used in the analytical laboratories to separate and analyze for priority pollutants, drugs, and other chemicals of environmental and social concern; in the organic laboratory, to enable complete characterization of an unknown and the target molecule in a synthetic project; and in the inorganic laboratory, to separate and analyze organometallic compounds synthesized in the laboratory, such as tris (acetylacetonate manganese (III). In the physical chemistry laboratory, it is being used to verify mechanisms via a kinetic isotope effect, as in the iodination of acetone. A significant number of students do research both during the academic year and during the summer. The students doing undergraduate research are finding the GC- MS indispensible in their work.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Harris S. Shultz TPE 8652394
Orange County Supt of Schools FY87 $473,224
Costa Mesa, CA Mathematics

"The C3 Teacher Training Project"

This school system/university pre-algebra project will establish intensive five-week summer institutes with academic-year workshops for 30 sixth-through-ninth grade teachers of underrepresented female and minority students in post-Algebra I mathematics classes. The goals are to :

- upgrade the mathematical knowledge, teaching strategies, and expectations of these teachers;
- develop, teach and revise the specially designed pre-algebra curriculum being taught to ninth graders attending a summer camp on the same site as the teacher institute;
- significantly increase the number of underrepresented students succeeding in higher level mathematics classes; and
- produce fifty resource modules.

For three successive summers (1987,1988,1989) teachers from an Orange County school district (different district each summer) will attend five-week institutes at California State University, Fullerton. These teachers' mathematical backgrounds will range from the expert to the novice. The activities will include articulating the special learning needs of the students, teaching the modules and videotaping the sessions, revising the modules based on student feedback, and teaching the revised version to a new class within two days. The activities of the academic year follow-up include seven two-day workshops and the establishment of an electronic bulletin board network.

The evaluation will assess the level of reaction to the training process; acquisition of knowledge, skills, attitudes; application of learned skills and strategies; and changes occurring in students and schools.

COLLEGE SCIENCE INSTRUMENTATION

Homer D. Garcia USE 8750888
Pitzer College FY87 $37,900
Claremont, CA Social Science

"Statistical-Quantitative Methods in the Social Sciences"

A computer laboratory designed to supplement instruction in the social sciences is being created. The students are being exposed to the statistical and other quantitative data analysis techniques applicable in their major. The students are being given opportunities or hands-on experience in class as well as in independent studies computer-based research experiences. With the use of the Micro Vax II in a networking arrangement as well as SPSSX and BMDP Statistics software the students are expanding their experience in computer-based analysis. The mini-computer is being used in advanced statistics classes as well as with large data sets in political science, economics, and sociology. Since many of the students continue on to graduate school there is a need for increasing the statistical and other quantitative skills as well as the ability to generate such data on the computers.

COLLEGE SCIENCE INSTRUMENTATION

David W. Becker USE 8852604
Pomona College FY88 $36,471
Claremont, CA Biology

"Equipment for a Modern Undergraduate Laboratory in Plant Biology"

This project is providing modern laboratory equipment to establish a contemporary cell and molecular plant science teaching program. Two upper-level laboratory courses are affected: Plant Physiology, and Plant Growth and Development. Plant Physiology currently is undergoing complete renovation at the hands of the principal investigator (who was hired a year ago to fill the department's void in modern plant laboratory sciences). Plant Growth and Development is a new course, offered for the first time in 1987-1988.

The equipment is fitting out two entire laboratory courses in a manner that allows students to observe fundamental principles in plant biology and to gain experience in methodologies currently employed in plant science laboratory research. As direct result of this grant, students are having an opportunity to utilize the following techniques in their study of plant processes: fluorescence and gas exchange at the whole leaf/whole plant level, organella isolation and characterization, suborganella fractionation, polarographic gas assay in solution, electrophoretic separation of proteins and quantification by scanning densitometry, immunochemical assays including Western blots and enzyme-linked immunosorbant assays, and in vitro translations.

Plant molecular and cell biology currently are areas of intense research efforts which are generating a great deal of excitement. An objective of this project is to transmit some of that stimulation to the local level. Some of the equipment also is being used in other upper-level laboratory courses by biology majors, a majority of whom continue their formal education in either graduate or professional schools.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Richard S. Lewis USE 8750744
Pomona College FY87 $6,205
Claremont, CA Psychology

"Laboratory Equipment to Improve Undergraduate Instruction in Physiological Psychology"

This project will provide laboratory equipment to improve undergraduate instruction in the physiological processes involved in human cognition. The equipment purchased would present, record and analyze event-related potentials (ERP). Students taking courses in the physiological basis of behavior will learn the fundamental principles involved in ERPs, gain experience in its operation in a variety of experiments investigating the relationship between physiology and cognition, and will learn experimental applications of this technique.

STUDIES AND ANALYSES

Daniel Koretz	OSPA 8850377
Linda Darling-Hammond	FY88 $318,166
Rand Corporation	FY89 $340,125
Santa Monica, CA	Studies

"Developing and Evaluating an Indicator System to Monitor Mathematics and Science Education"

This project, conducted by the RAND Corporation, involves the collection and integration of large national data bases to design and develop indicators of the status and condition of precollege science and mathematics education. Four areas of science and mathematics education will be included in the indicator system: teachers and teaching quality; curriculum and instruction; participation (especially, that of women and minorities); and, achievement and outcomes. The methods to be used to develop the indicator system will be to: 1) synthesize data from an array of national data bases to obtain additional information on the condition of science and mathematics education; 2) evaluate the results to determine the strengths and weaknesses of the existing data and the indicators that can be built from them; and, 3) use a wider variety of data--including data that are not nationally representative--to explore the potential of components of measures that might be useful for future data collection efforts.

APPLICATIONS OF ADVANCED TECHNOLOGY

David J. McArthur	MDR 8751515
Rand Corporation	FY87 $284,337
Santa Monica, CA	FY88 $297,257
	FY89 $318,832
	Mathematics

"Computer-Based Learning Tools for Basic Algebra"

The main aim of the project is to conduct computational investigations of intelligent tutoring tools, in coordination with empirical studies both in the field and in the laboratory.

The main computational goals are to expand the pedagogical expertise of an algebra tutor, and to investigate tutoring tools that can help students learn new kinds of algebra skills in novel learning situations. In developing the current algebra tutor, the project director discovered that little research precisely describes teaching tactics and strategies. The project's pedagogical enhancements to the algebra tutor attempt to formalize such knowledge, and to provide a computational framework for testing representations of pedagogical policies.

In addition to developing pedagogical enhancements, several algebra tools or environments will be constructed. Each tool will be designed to help students learn skills that are not taught in the traditional algebra curriculum, including higher-level problem solving skills, and skills in problem finding and formulation. The tools will also allow students to learn using regimes other than traditional drill-and-practice. They provide a situated problem solving environment that embeds mathematical reasoning in a meaningful context.

Empirical studies will be conducted in both field and lab settings. Continuing field-based research in the local high school will involve relatively formal studies of facets of the tutor and the algebra tools, while the lab studies will test software at a much more formative stage.

STUDIES AND ANALYSES

Jeannie Oakes	OSPA 8652467
Rand Corporation	FY87 $138,503
Santa Monica, CA	Studies

"The Distribution of Science and Mathematics Education"

This project addresses the NSF's concern about low levels of science and mathematics participation and achievement among minorities, the poor, women, and students not college bound. RAND proposes to analyze data from the 1985 National Survey of Science and Mathematics Education a survey previously supported by NSF at the Research Triangle Institute, which covered a sample of 1200 elementary and secondary schools and 6000 mathematics and science teachers. This present project will be designed to improve understanding of: 1) how resources, teacher quality, curriculum, and instructional practices are distributed among various student groups, and 2) whether this distribution may shape the opportunities to learn of groups that typically exhibit low participation and achievement levels. Because distributional questions will be addressed at both the school and classroom levels, the study will provide clues as to whether learning opportunities of students in various groups relate to: 1) the particular school a student happens to attend; 2) how opportunities are provided to different students in the same school; 3) combined school and classroom factors. These analyses will provide the first detailed national picture of the conditions under which patterns of unequal outcomes have occurred and point to specific targets for policies and programs addressed at remedying participation and achievement discrepancies.

RESEARCH IN TEACHING AND LEARNING

Cathleen Stasz	MDR 8751104
David J. McArthur	FY87 $300,695
Rand Corporation	Mathematics
Santa Monica, CA	

"The Cognitive Skills of Tutoring in Algebra"

The research literature contains few documented reports on the strategies and tactics used by teachers in one-to-one tutoring situations and the learning effects related to same. This paucity of information exists even as vast amounts of educational research is being focused on effective classroom teaching.

The goal of the research proposed here is to develop a cognitive skills-model of one-to-one tutoring in algebra. The Model will explicate specific tutoring strategies and tactics at a more precise level of detail than is currently available. This problem will be approached from an "expert systems" point of view where the target expert is a master high school algebra tutor. This teacher will be videotaped and the tapes analyzed to determine the cognitive skills involved in the teacher-student interaction. The cognitive skills discovered will be represented as formal knowledge structures, and then, as far as possible, implemented in the pedagogical module of an intelligent tutor for algebra.

The development plan involves the initial observation of the expert teacher, viewing of the videotapes and both debriefing and followup interviews with the expert teacher, model validation by both the expert tutoring system with students in school settings. Input from mathematicians, mathematics educators, and teacher educators will help guide the development of the expert tutoring system.

The proposed research is challenging and has the potential of expanding the frontiers of mathematics education. It has been carefully designed to move beyond routine "symbol manipulation" tutors.

INFORMAL SCIENCE EDUCATION

Judy Diamond MDR 8751709
San Diego Society of Natural History FY88 $190,812
San Diego, CA Geology

"Applications of Interactive Minerals Exhibits in Natural History Museums"

The San Diego Natural History Museum is developing a new permanent Minerals Hall that will present geology and mineralogy to visitors through displays of outstanding mineral specimens and through interactive exhibits on the physical properties of minerals.

This NSF award will support the design, construction and evaluation of the interactive exhibit components. In addition to the permanent exhibits at the San Diego Natural History Museum, an additional set of exhibits will be prototyped, tested, and installed in a new Great Lakes Exhibit at the Cranbrook Institute of Science (Bloomfield Hills, MI). The two institutions will collaborate on exhibit design and development and carry out parallel evaluations with their respective museum audiences. NSF support will be approximately 45% of the project total.

COLLEGE SCIENCE INSTRUMENTATION

Kasi Ananthanarayanan USE 8852913
San Diego State University FY88 $27,707
San Diego, CA Computer Science

"Multiprocessor Architecture for Undergraduate Instruction"

The equipment funded by this award permits undergraduate students to carry on programming assignments, large scale projects and undergraduate research in the areas of parallel architectures, distributed operating systems, fault tolerant systems and their applications in various areas. The equipment that supports this project includes ten Motorola processor boards and a host computer to house them, the UNIX operating system, ethernet controller, and a collection of software for the environment.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Steven M. Day USE 8852606
San Diego State University FY88 $12,495
San Diego, CA Geology

"A Twelve-Channel Seismograph for Field Work in Undergraduate Geophysics"

This project will strengthen undergraduate instruction in geophysics, and will create research opportunities for undergraduates through the acquisition of a portable exploration seismograph. The instrument to be purchased is an EG&G Geometrics Model ES-1225 twelve channel exploration seismograph. This unit, which has modern microprocessor technology and digital signal enhancement capability, will replace a 15-year-old single channel seismograph.

The new instrument will be used in four undergraduate geophysics courses to teach basic principles of data acquisition in seismic exploration; use of computer software for playback, analysis and interpretation of seismic data; and concepts of digital recording, filtering, and signal enhancement. The unit also will be used by undergraduates for senior thesis research in geophysics, hydrogeology, and engineering geology.

This award will be matched by an equal amount of non-federal funds.

RESEARCH IN TEACHING AND LEARNING

Fred M. Goldberg	MDR 8751901
San Diego State University	FY88 $167,696
San Diego, CA	FY89 $142,457
	FY90 $106,790
	Physics

"Coupling Ray Diagrams and Real World Phenomena in Optics"

This project builds on previous research by physics educators and cognitive scientists and addresses an important instructional problem in science teaching: how to facilitate the process by which students learn to connect real world phenomena with scientific representations of the phenomena. The domain of focus is geometrical optics and the main population of interest consists of pre-service elementary school teachers.

The project activities cover two major areas. The investigations: (1) Will develop a general template which will be used for specifying an individuals's mental model about optical phenomena. The template will be used to describe how the physics expert's and the student's mental models differ, and also to describe changes in a student's mental model during various phases of instruction. (2) Will investigate the effectiveness of an instructional strategy, based upon the psychological principle of simultaneous encoding of information, to facilitate students' abilities to connect ray diagrams and optical phenomena. In this strategy ray diagram representations will be simultaneously presented with the visual demonstration of the related optical phenomena. Finally, the investigators will develop a videodisc with a myriad of examples of optical phenomena, and will use the text and graphics overlay capabilities of a computer videodisc system to implement the instructional strategy.

TEACHER ENHANCEMENT PROGRAM

Frank A. Holmes	TPE 8751552
San Diego State University	FY88 $131,787
San Diego, CA	FY89 $153,925
	FY90 $149,035
	Other NEC

"San Diego Mathematics/Science Academic Enrichment Project"

The San Diego Mathematics Academic Enrichment Project is a three-year program for elementary teachers of underrepresented minority students, undergraduate students who are majoring in mathematics education, and minority elementary students. The project will also provide mathematics enrichment activities to 150 2nd, 3rd, and 4th grade students and their families. The instruction will be in the form of workshops where the children will be taught, in part, by minority San Diego State University engineering, science, mathematics and education students. The instructional activities will take place in a San Diego public elementary school after school three days each week. University, school district, church, and community organizations are forming a multi-faceted partnership to provide the enhancement, preparation and intervention in a laboratory setting. This consortium will make a 60% match of National Science Foundation funds.

COLLEGE SCIENCE INSTRUMENTATION

Joseph Katz	USE 8851535
Nagy S. Nosseir	FY88 $47,615
San Diego State University	Mechanical Eng
San Diego, CA	

"Data Acquisition System for Wind-Tunnel Laboratories."

The wind-tunnel laboratories used in this institution's Aerospace Engineering program are updated and improved, exposing students to modern computer-aided wind-tunnel technology. A minicomputer, with graphic capabilities, is interfaced to the wind- tunnels so that students can carry on experiments using real-time data acquisition and analysis. This modernization of equipment and analytic techniques exposes students to laboratory computer technology, enhances the study of experimental/analytical fluid dynamics and better prepares students for the aerospace industry and graduate study.

This award is being matched by an equal sum from the grantee.

RESEARCH IN TEACHING AND LEARNING

Judith Threadgill-Sowder	MDR 8550614
San Diego State University	FY86 $218,711
San Diego, CA	FY87 $164,760
	Mathematics

"The National Council of Teachers of Mathematics Research Agenda Project"

Research efforts in some areas of mathematics education have developed to a point where consensus is needed to establish a conceptual framework to guide future inquiry. The Research Advisory Committee of the National Council of Teachers of Mathematics has identified four such areas: teaching and learning of middle school number concepts, effective mathematics teaching, the teaching and learning of algebra, and the teaching and evaluation of problem solving.

The proposed project will establish working groups in these areas. Each of the four groups will meet for a four-day conference to consider the significant issues in the area. Each conference will feature presentations by authors of invited papers, small group discussion sessions, and plenary sessions. The purposes of these conferences are to synthesize the current knowledge base in each area, identify significant directions for future research, and develop collegial research groups. Four monographs, one from each working group conference, will disseminate invited papers, conference proceedings, and the research agendas established by the conference participants. A fifth monograph will contain a variety of viewpoints on the proceedings and resulting agendas through retrospective papers by members of the project advisory council.

RESEARCH IN TEACHING AND LEARNING

Judith Threadgill-Sowder	MDR 8751373
San Diego State University	FY87 $109,467
San Diego, CA	FY88 $112,450
	FY89 $ 46,230
	Mathematics

"Relating Mental Computation, Number Sense, and Computational Estimation"

Mental computation and computational estimation are receiving considerable attention as curricular topics for elementary and middle school mathematics, mainly because they serve important functions in a calculator-literate society. A careful study of the role of these topics in the curriculum is warranted based on recent research which shows that the development of computational estimation is closely related to the development of mental computation skills and number magnitude concepts.

To explore the interrelationships of mental computation, computational estimation, and number sense, a longitudinal research project involving students in grades four, five, six, and seven is planned. Long-term instruction on mental computation and number magnitude will be given in grades four and five. The effects of this instruction on number sense development will be evaluated both during the instructional period and the following year. Instruction on mental computational and number magnitude will be provided in grade six, and instruction on computational estimation in grade seven. The influence of the grade six instruction on the acquisition of computational estimation skills will be studied by comparing performances of seventh grade students with and without the sixth grade instruction. Transfer effects to related topics such as rational numbers will also be studied.

COLLEGE SCIENCE INSTRUMENTATION

Roger E. Whitney	USE 8750569
San Diego State University	FY87 $18,647
San Diego, CA	Computer Science

"Computer Aided Learning Lab for Undergraduate Computer Science"

Under this project, an Appletalk Local Area Network will be set up linking 16 Macintosh computers, a hard disk, and two Imagewriters. The resulting laboratory will be used for the undergraduate teaching of programming algorithms. Besides graphics, dynamic animation of data structures and algorithms, the timing and measurement of algorithms, and the associated data analysis and graphing will be used in the laboratory.

COLLEGE SCIENCE INSTRUMENTATION

David Wright	USE 8750415
San Diego State University	FY87 $50,000
San Diego, CA	Electrical Eng

"Digital Techniques in an Undergraduate Electrical Engineering Laboratory"

Demonstration of the use of digital techniques in representative electrical engineering contexts is the object of the proposed laboratory. The associated course is aimed at EE seniors and is comprised of a set of experiments which broadly exhibit the use of digital processing within EE systems. Eight similarly equipped student stations plus a central station for one-of-a-kind equipment form the ensemble purchased under this grant. Each station includes a unit for capturing, processing, and creating electrical waveforms. These units are basically general purpose micro-computers augmented with data acquisition and control modules. Additional instrumentation to create and observe signals, to produce output action, and to record results is proposed also and includes signal generators, transducers, oscilloscopes and other items of general purpose test equipment. The laboratory course is new and self-contained and complements several undergraduate EE courses for which no supporting laboratory activity currently exists. Many experiments involve the physical senses. Together they demonstrate: the basic effects of quantization in time and in amplitude; serve action with an imbedded digital processor; random process phenomena; digital filtering; and signals encountered in telephony robotics, biomedical instrumentation, et cetera.

RESEARCH IN TEACHING AND LEARNING

Fred M. Goldberg	MDR 8696103
San Diego State University Foundation	FY86 $92,800
San Diego, CA	FY87 $ 3,000
	Physics

"Empirical Investigation of Difficulties in Understanding Optics, Kinematics, and Heat and Temperature Among Pre-College Teachers"

Often students bring with them into their college physics and physical science courses preestablished beliefs about physical phenomena which are at odds with correct scientific principles. These "alternative conceptions" can contribute great difficulty to students who are struggling to learn physics. This project will investigate such alternative conceptions, held by inservice elementary and middle school teachers and by preservice teachers before formal instruction in their college science courses.

These investigators will then examine some of the difficulties that such preservice teachers have in understanding physics during formal instruction. The research will be carried out in the content areas of optics, kinematics, and heat and temperature. The primary data source will be the "individual demonstration interview," in which the student is asked to make predictions and give explanations for a variety of tasks involving real apparatus. Once information is obtained from the interviews about the nature of specific difficulties, their prevalence will be determined by administering questionnaires to class-size groups. This project will also develop and use three computer simulation/videotape programs to gather information from individual students.

The results of this research will be disseminated through publications, through presentation at professional meetings and through workshop materials for college and high school teachers to be developed by the principal investigator.

COLLEGE SCIENCE INSTRUMENTATION

Sergio Aragon	USE 8851530
San Francisco State University	FY88 $39,327
San Francisco, CA	Biology

"Ultraviolet-Visible Spectrophotometers for Undergraduate Biochemistry Laboratories"

The goal of this project is to improve the undergraduate laboratory curriculum by incorporating student work utilizing microprocessor-controlled ultraviolet-visible spectrophotometers. These are used primarily in three upper division laboratory courses: Biochemistry Laboratory and the two-semester Integrated Laboratory. All undergraduates take one or more of these courses, and so receive training in the theory and practice of this instrumentation. These new spectrophotometers introduce important new learning capabilities: flexibility for conducting new experiments as well as updating present experiments, the introduction of derivative spectroscopy in qualitative and quantitative analysis, efficient and rapid data acquisition coupled with powerful data processing capability, training in the practice of computer-interfaced instrumentation for data storage and retrieval, post acquisition processing and computer remote control, and the production of graphical results and spectral manipulations such as least squares fitting, peak integration and spectral subtraction.

A solid set of scientific and pedagogical goals is being pursued in this project. Eight specific experiments requiring modern spectrometers are being adopted. While the previous classroom curriculum covered the theoretical aspects of modern spectroscopy, laboratories were burdened by a lack of modern instrumentation. Since the department strongly stresses the "hands-on" experience required for careers in modern chemistry, biochemistry and biotechnology, the lack of proper spectrophotometers was particularly acute. The courses being improved serve as an important training ground for employment in high- technology industries in the Bay Area, as well as for the approximately 30-40% of this department's graduates who matriculate to post- baccalaureate studies.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Jennifer Breckler	USE 8852338
San Francisco State University	FY88 $47,200
San Francisco, CA	Biology

"Undergraduate Laboratory Instrumentation For Cell Biology"

The new instruments provided through this award, along with equipment already held by the department, is supporting the creation of an important new central laboratory facility for teaching cellular biology. The facility serves seven upper biology component. Of these courses, four use the facility on a full-time basis; the remaining three courses utilize the facility on a pre-arranged academic schedule to conduct laboratory exercises which require cell biology instrumentation.

The new equipment is being used for the preparation and analysis of living cells. Major items include laminar flow hoods, a fluorescence microscope, an infrared gas analyzer, and a scanning spectrophotometer. As a direct result of the acquisition of this equipment, the core curriculum in cell biology is being substantially upgraded. The project permits the development of new cell biology experiments, lower division demonstrations, and the improvement of existing lab exercises. These improvements are bringing state-of-the-art techniques to the curriculum and reinforcing the teaching of modern cell biology principles, thus better preparing undergraduates for future jobs and/or graduate studies.

The grantee is matching the NSF award with a slightly greater sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Crellin Pauling
Kathleen O'Sullivan
David R. Stronck
Lane Conn
San Francisco State University
San Francisco, CA

TPE 8751790
FY88 $318,820
Biology

"A Teacher Training Program in Biology: The Science, Techniques and Ethics of Molecular Biology"

This program is designed to provide enhancement training for seventy-two inservice high school biology teachers in recent discoveries in molecular biology and biotechnology. This program will provide training at three sites in northern California, San Francisco State University, University of California, Santa Cruz, and California State University, Sacramento.

Teachers will be involved in a two-week intensive workshop, using materials developed at Cold Spring Harbor, plus a three-day science and society symposium in which issues arising from the new biotechnology will be discussed with a view toward inclusion into a high school biology class. Less well prepared teachers will spend four additional days in a pre-workshop at San Francisco State to enable them to keep pace with their colleagues who have a deeper background in biology. Curriculum guides will be developed to facilitate in the integration of this material into the curriculum in participants' schools. A good follow-up schedule will provide them with the resources to implement this program.

COLLEGE SCIENCE INSTRUMENTATION

Leslie V. Foster
Jane M. Day
San Jose State University
San Jose, CA

USE 8852808
FY88 $48,182
Mathematics

"Computing Equipment for Realistic Modelling"

Four very fast numerical coprocessors will enable the incorporation of realistic models into undergraduate applied mathematics curriculum; solution of numerically complex problems posed by industry; and enhancement of the new bachelors degree program in Applied and Computational Mathematics.

The equipment will provide high speed computing and good graphics in a networked environment for upper division applied mathematics courses and industrial projects. Numerical Analysis, Linear and Non-linear Programming, and Partial Differential Equations will introduce realistic modeling which minimizes the programming required so that the mathematics concepts, techniques and graphical output can be emphasized. Faculty workshops in the curriculum and equipment use will be formed.

The grantee is providing an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Leon S. Yengoyan
San Jose State University
San Jose, CA

USE 8750906
FY87 $29,116
Chemistry

"Introduction of Gas Chromatography - Mass Spectrometry (GCMS) into the Undergraduate Chemistry Curriculum"

The recent acquisition of a gas chromatograph/mass spectrometer (GC/MS) system (including a computer-controlled work station) by the Chemistry Department at San Jose State University is providing undergraduate students with a hands-on working experience in a modern and powerful analytical technique vital for training the modern chemist in such fields as organic and analytical chemistry, toxicology, forensics, and environmental sciences. Extensive use of the system occurs in a new Separation Science Course, with additional use in the organic and biochemistry laboratories, as well as in undergraduate research, resulting in significant enhancement of the chemistry curriculum.

TEACHER ENHANCEMENT PROGRAM

David Logothetti
Santa Clara University
Santa Clara, CA

TPE 8550571
FY86 $88,615
FY87 $93,000
Mathematics

"High School Teachers Honors Workshop in Integrated Mathematics"

This Leadership Activities project will provide enhancement and professional development experiences for 25 exemplary secondary school mathematics teachers from Santa Clara County, California public and private schools. The overall goals of the two-year project involve the updating and deepening of the participants' knowledge of problem solving and integrated approaches to school mathematics topics and teaching methodologies, the networking of the participants and university mathematics faculty, the conduct of follow-up sessions and in-service workshops by the participants in their home schools, appropriate recognition for honors teacher participants, and the investigation of the modelistic approach within a carefully planned documentation, assessment and evaluation effort.

Selections of participants will be based upon detailed applications requiring expressions of teacher and school commitments to implement project emphases. Working with university mathematicians, the participants will complete a 16-day summer workshop and eight monthly, day-long meetings designed to increase their conceptual understanding of, and commitments to, integrated treatments of mathematical topics, to develop strategies and teaching plans for problem-solving applications in their own curriculum, and to develop materials and techniques for use in their presentation of in-service workshops. They will earn graduate academic credits from the University of Santa Clara. During the preparation of the in-service workshops which the participants will design and conduct, the project staff will be available for consultation and support. Participants will be visited and observed in their classrooms and in their workshops with their peers. Careful documentation and analysis of these observations and of teacher reports will provide a significant basis for a detailed project evaluation.

Steven M. Rubin	CISE-8712135
Schlumberger Palo Alto Research Lab	FY87 $13,500
Palo Alto, CA	Computer Science

"Introduction of Course on VLSI CAD Tools"

Dr. Rubin has just published a book, "Computer Aids for VLSI Design", which will be the basis for a course of instruction with the express purpose of preparing university faculty members to teach a course in VLSI design and tools. The setting for the course will be Stanford University, where the students can visit a forefront VLSI research center, the Center for Integrated Systems. Dr. Rubin is exceptionally well qualified to teach the course because of his accomplishments in both research and teaching of CAD topics.

VLSI (very large scale integration) is a recent field that explores how to design highly complex integrated circuits and related electronic systems. The need for this field of study is clear from trends in current technology. Development of the field is important to the nation's competitive lead in electronics. There are instructional materials at the level of detailed circuit design; but until now, there have been no instructional materials dealing with the scope and use of computer-aided design (CAD) tools necessary for VLSI design development. A new textbook which fills this gap in VLSI education has been written by the principal investigator and recently published. This book, "Computer Aids for VLSI Design", presents a broad view of the tools necessary for modern VLSI design systems. The instruction proposed by the principal investigator will educate a core of instructors who can return to their institutions with an in-depth knowledge of VLSI design tools and prepare courses on their use.

COLLEGE SCIENCE INSTRUMENTATION

Jean B. Chan	USE 8852470
Sonoma State University	FY88 $8,270
Rohnert Park, CA	Mathematics

"Development of a Modern Undergraduate Mathematics Laboratory"

The Department of Mathematics will initiate a first phase of a mathematics laboratory for several courses. In remedial mathematics, students will work problems in algebra and geometry, while in calculus, students will conduct experiments. In addition, the Mathematical Models and Numerical Analysis curriculum will be updated and classes will be held in the mathematics laboratory.

The grantee will provide an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Richard H. Gordon	USE 8750557
Sonoma State University	FY87 $17,973
Rohnert Park, CA	Computer Science

"Development of a Modern Undergraduate Computer Graphics Laboratory"

An undergraduate computer graphics laboratory using a DEC Microvax II will be acquired. Using interfaces, the computer will serve as a dedicated machine with four existing graphics terminals. Two undergraduate courses will be supported by the laboratory, and seniors will use the laboratory for special projects such as processing astronomical images and producing geological maps.

TEACHER ENHANCEMENT PROGRAM

Douglas R. Martin	TPE 8751303
Sonoma State University	FY87 $44,097
Rohnert Park, CA	FY88 $19,313
	Physical Science

"Materials and Assistance for Science Teaching-Project MAST"

The purpose of this project is to design and evaluate a cost-effective model program for improving science instruction in all 125 elementary classrooms of the Cotati-Rohnert Park Unified School District. Project MAST will adapt existing effective elementary teaching materials and methods to meet the curricular objectives established by the school district in its program to implement a comprehensive and articulated elementary science program. This two-year project will devote its first year training teachers to adapt effective teaching techniques and materials to the specific objectives identified by the school district and to produce instructional kits, which will include both physical teaching materials and teacher instruction and background information.

This design and production effort will be carried out by a team of school district teachers and university specialists in elementary science education. Special emphasis will be placed on including many district teachers in field trials and evaluation of teaching materials in order to encourage teachers to commit to the project.

The second year of Project MAST will be devoted to inservice training of all 125 district elementary teachers. District science mentor teachers will be responsible for providing four days of training for each teacher in the use of the instructional kits and for providing support as required. The evaluation of the project will include a longitudinal analysis of the actual classroom use of the instructional units and analysis of anecdotal evidence concerning the reactions of teachers to the project.

RESEARCH IN TEACHING AND LEARNING

James G. Greeno	MDR 8718918
Stanford University	FY87 $64,846
Stanford, CA	FY88 $67,883
	FY89 $71,250
	Mathematics

"Concepts and Meanings of a Formal Domain"

This project will develop a scientific analysis of the knowledge and processes involved in understanding algebra at the high-school level. The research will use three main approaches: One approach is analysis of conceptual growth, a method that has been used productively in the study of cognitive development. The second approach uses tasks taken from the mathematics curriculum and related tasks designed to show what students are able to do and what knowledge they have that enables them to do it. The third approach uses methods of artificial intelligence to construct models of students' knowledge and cognitive processes.

The research will focus on students' understanding of the concepts of variables and functions and how this understanding relates to their knowledge of the symbolic expressions of algebra. The research on conceptual growth will study students' ability to reason about two physical systems involving functional relations: a winch in which the final position of a block depends on several factors, and a transfer of liquid from one cylinder to another, where the final height of liquid depends on several other factors. Previous research has shown that students have significant understanding of functions in these systems before they study algebra, and this research will document the increases in students' understanding as they study relevant formal mathematics. The research on understanding symbolic representations will study students' understanding of the meanings of formulas and graphs and their relations. Tasks used in these studies will include problems that are included in the curriculum, as well as more open-ended tasks designed to tap specific aspects of students' understanding. The research on computer modelling will use the results of the empirical studies to develop definite hypotheses about specific knowledge that students acquire in order to perform tasks in the curriculum and other reasoning tasks when they understand the concepts, and about the ways in which that understanding changes and grows.

Increased scientific knowledge about the understanding of concepts in algebra will contribute to our understanding of the domains of conceptual growth and the analysis of understanding the meanings of symbols. Previous research on conceptual growth has studied informal domains of knowledge, such as taxonomic categories and biological processes. This research will extend those analyses by studying algebra, a domain with a formal structure. Most previous studies of symbolic understanding have focused on ordinary language, and the study of understanding the formal system of algebra will provide new insights into ways that meanings of symbolic representations are understood. Results will also be useful in the improvement of school instruction in algebra and for other training in which mathematical understanding is important.

This project is funded jointly with the Directorate for Biological, Behavioral and Social Sciences.

APPLICATIONS OF ADVANCED TECHNOLOGY

Patrick Suppes	MDR 8751523
Stanford University	FY87 $468,452
Stanford, CA	FY88 $524,704
	Mathematics

"Computer-Based Integral Calculus for High Schools"

This project addresses the general problem of how the tools of symbolic computation can be used in the context of calculus instruction in high schools. For many years there have been programs, such as REDUCE, MASCYMA, SCRATCHPAD, and MuMATH, which can perform symbolic computations that are required for the solutions of calculus exercises. These powerful programs have been used mainly by researchers in many areas of pure and applied mathematics and in practical engineering applications. The REDUCE algebra system will be adapted for instructional purposes by building a set of sample computer-based lessons in integral calculus.

These lessons, combined with earlier work on the differential calculus, will cover all the standard material of the College Board's recommended curriculum for advanced placement calculus, AB. In addition to the use of REDUCE as an "algebra engine", the lessons make full use of high-resolution graphics, and the software is intended to be delivered to students on individual workstations.

Most importantly, the software for problem-solving and calculus exercises will be able to keep track of the validity of the steps the student makes and detect and inform the student about incorrect steps. The overall environment is one in which algebraic and graphics tools are embedded in a framework of valid mathematical inference. In addition, this project is developing an interactive theorem-proving system in which very able students can prove the main theorems of real analysis which are relevant to concepts in first-year calculus.

During the academic year 1988-89 the lessons will be tested with a small number of high school students. The lessons will be available for wider use in January, 1990.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Richard N. Zare	MDR 8751200
Stanford University	FY87 $28,386
Stanford, CA	FY88 $29,704
	Chemistry

"Development of Laser Experiments for Illustrating Chemical Principles"

Experiments will be developed to illustrate the use of laser techniques in demonstrating and understanding chemical principles. Emphasis will be placed on the use of a helium-neon laser source which is inexpensive, safe, and readily available. These experiments are being designed for use in the classroom or for lecture demonstrations or for use by highly motivated high school students or beginning undergraduate chemistry students. Although the use of lasers to demonstrate optical phenomena is fairly well advanced, their counter- part in chemical applications remains in a highly primitive state, even though laser techniques are revolutionizing chemical research. Funds will allow for the exploration of suitable laser chemistry experiments for the secondary school and beginning undergraduate curriculum. Simple, "hands-on" experiments will be produced for student use under the supervision and guidance of a teacher.

For the most part, the science curricula of the secondary schools is in serious need of revision. This project shows the way to bringing new technologies into the secondary school chemistry program and provides a model for similar action in biology and physics programs. This project will also provide useful and current experiments for use by talented and motivated students.

In the second year, this project will continue to explore how a simple helium-neon laser may be used to augment the teaching of chemical principles. The project staff have recently concentrated on developing a set of electrochemical experiments which illustrate important points concerning electron transfer from iron (II) to iron (III) complexes. This material is intended to enhance the teaching of electrochemistry in high school classes and to provide directions for independent research project for well motivated students.

Electrochemistry is a topic usually covered at the end of the high school year and is often bypassed or treated in too shallow a fashion. Good demonstrations or labs may inspire the teacher to "keep it" in the curriculum. There are many bonuses in this relatively simple set of experiments in that they show the close relationship between electrochemistry and inorganic and analytical chemistry. It is also hoped that the student will gain some insight into the environment about the central metal ion in solution and into some methods of electron transfer relative to that environment.

INFORMAL SCIENCE EDUCATION

Robert J. Semper	MDR 8550498
The Exploratorium	FY85 $ 50,000
San Francisco, CA	FY86 $159,050
	FY87 $220,067
	FY88 $ 6,000
	Biology

"The Development of a Series of Exhibits Concerning Cellular and Molecular Biology"

The Exploratorium, a science museum located in San Francisco, proposes to develop a series of 35 interactive biological science exhibits - an area which has not been explored or developed extensively by the museum community. The exhibits will focus on the biochemistry and biophysics of cells and will include displays on osmotic pressure, electrical potentials, biological oscillations, feedback and control using living animals and plants. Additionally, they will integrate the use of film, video, video disk and computer graphics with the exhibits. The exhibit will be shared with the New York Hall of Science and results will be shared with other museums at an invitational conference.

The area of cellular and molecular biology is one of the most significant, timely, exciting and intellectually engaging areas in science today. It is important that the museum community explore and develop exhibits in this fascinating and difficult area.

TEACHER ENHANCEMENT PROGRAM

Robert J. Semper	TPE 8751776
Lynn Rankin	FY88 $216,350
The Exploratorium	FY89 $233,389
San Francisco, CA	FY90 $244,078
	Physics

"School in the Exploratorium Leader Teacher Program"

School in The Exploratorium Leader Teacher Program is a two-tiered program consisting of a series of ten-day introductory workshops designed to introduce 300 teachers to a basic approach to hands-on science instruction and a two-year leader teacher internship program designed to develop a cadre of 78 well-trained leadership teachers working in the same districts who understand the principles of inquiry- based learning and can support the activities of their colleagues. The three-year program is based physically and philosophically at the Exploratorium, taking advantage of its exhibits and other facilities to create a rich atmosphere for learning content and process. The program will make it possible for 378 elementary teachers to have support in the classroom by Exploratorium staff and artists and use a Lending Library of materials as they learn an integrated science-and-art approach to the investigations of nature and the everyday world.

TEACHER ENHANCEMENT PROGRAM

Robert J. Semper	TPE 8751747
Christopher de Latour	FY88 $690,883
The Exploratorium	Life Science
San Francisco, CA	

"Exploratorium Teacher Institute"

The main goals of the project are to build upon the excellent previous work that has taken place at the Exploratorium which utilizes the resources of a museum to offer enriching experiences to practicing teachers and develops models of inservice programs. The plan in the proposed project is to work with 600 teachers at the middle school and high school levels from all of the school districts in the greater San Francisco area. It is planned to emphasize exploratory activities in physical science(70%) and mathematics(30%) by offering the teachers an immersion into subject-oriented activities which they in turn can adapt as possible experiences for their students. The model which is under development consists of three basic stages. The first establishes small-group workshops which revolve around a curriculum suggested by the rich environment of the Exploratorium exhibits. The second phase enables the teachers to learn to use the Exploratorium as a resource center to enrich their learning and provide a source of information and potential activities for their students as well as a central location to share their ideas with their colleagues. The third phase in the model develops a support mechanism for the teachers as they develop projects and activities. The summer institute involves 100 teachers in groups of 12 to 14 working 80 hours over a four-week period to focus activities on learning extensions of subject matter content using the exhibits. The academic year follow-up takes place during 6 Saturday morning sessions of 4 hours each and involves 40 to 65 teachers per session. The focus during these sessions is on the topics chosen by the teachers relating to potential topics to be covered in the school program. There are to be special projects according to the particular interests and needs of the teachers. For these projects the teachers have available to them the expert staff of the Exploratorium as well as the facilities and materials that are resident there. The after-school and Saturday workshops occur at 12 meetings during the year for four hours each. It is planned to arrange these in two blocks of six weeks each, during which there is a sharing of topics among the participants which encourages team teaching when possible. The non-NSF cost sharing is approximately eighty-five percent of the funded amount.

YOUNG SCHOLARS

Robert J. Semper	RCD 8850285
Darlene Librero	FY88 $100,000
The Exploratorium	Other NEC
San Francisco, CA	

"Exploratorium Explainer Program"

Since 1971, the Exploratorium Explainer Program has provided more than 1,000 young men and women of high school age with meaningful work and education opportunities in science and public education. In 1988, eighty to one hundred students from San Francisco and greater Bay Area high schools work as Explainers for one or two semesters. The Explainers' "job" is to help the Exploratorium's large and diverse public use and understand the interactive exhibits. The Explainers undergo intensive training in aspects of science before they begin working, and continue to attend weekend sessions on specific phenomena throughout their tenure at the museum. Explainers receive about seventy hours of formal instruction in science which is augmented by extensive one-on-one association between each Explainer and our Senior education, research and exhibit development staff. In addition, throughout the year the Exploratorium hosts visiting scholars and scientists, who discuss their work, as well as more general issues of scientific controversy and philosophy, with the Explainers.

Through hands-on experience -- building and operating actual demonstrations of phenomena, setting up biological experiments for the public, and maintaining exhibit apparatus -- the Explainers gain a deep familiarity with the fundamental concepts and activities of several scientific disciplines. Through daily contact with museum staff and visiting scientists, field trips to research sites, and other enrichment activities, they become acquainted with the day-to-day experiences of working in scientific fields.

TEACHER ENHANCEMENT PROGRAM

Jean G. Colvin	TPE 8751740
Thelma E. Rowell	FY88 $523,593
University of California Berkeley	Biology
Berkeley, CA	

"Partnerships in Field Research and Curriculum Enhancement"

The Partnerships in Field Research and Curriculum Enhancement project is designed to stimulate renewed interest in and improve the teaching of science at the precollege level by providing opportunities for K-12 teachers to join University of California (UC) scientists on field research projects in the natural and social sciences.

Workshops conducted before the field activities will provide an overview of each of the disciplines involved, major developments, and current directions. Teacher participants will then join U.C. field teams for two- to four-week periods in the summer on research projects in the United States and abroad. They will live with the scientific team at the field site, be instructed in basic field methods, and take an active part in data collection and analysis. After returning from the field, teachers will develop classroom curriculum materials based on their field activities. A series of academic-year workshops led by university scientists and curriculum specialists will provide assistance in curriculum development. Curriculum units developed by the teachers will be disseminated to interested educators through a teacher Research Resource Library.

The program is planned to operate over a three-year period. Approximately 100 teachers will participate. The program's impact will be extended through teacher presentations of field research experiences and dissemination of the curriculum materials.

This project allows the Teacher Enhancement Program the opportunity of placing teachers (K-12) in research situations. Subsequently the participants will plan teaching strategies to incorporate their research experience into classroom activities. Since many teachers have not been involved in research activities of any type, this type of program should result in a substantial change in doing science in the classroom.

APPLICATIONS OF ADVANCED TECHNOLOGY

Andrea A. diSessa	MDR 8642177
University of California Berkeley	FY86 $378,532
Berkeley, CA	FY87 $381,148
	Computer Science

"An Educational Computing Environment for 1990"

The team at MIT that was primarily responsible for developing the LOGO computer environment will design and implement a new educational computing system called Boxer that will be suitable for widespread use in schools beginning in the late 1980's. This will exploit the increased power of the next generation of microcomputers to provide a major increase in the breadth of applicability and ease of use of computers for students and educators. The system - which integrates programming, text-manipulation, information retrieval, and graphics - will be a medium for creating and distributing educational materials, as well as a personal tool for students and teachers.

The impact of this development will be felt directly - in reducing barriers to the use of computers in schools due to the complexity and narrow focus of today's software; and indirectly will produce a working implementation of the system, a technical specification that will enable the system to be adapted to a wide variety of computers, and prototype materials in science education that demonstrate the power of the system as a new medium for educational computing. System development will include cooperative design and testing of materials with students and teachers, and collaboration with beta-test sites.

APPLICATIONS OF ADVANCED TECHNOLOGIES

Andrea A. diSessa	MDR 8850363
University of California Berkeley	FY88 $679,584
Berkeley, CA	FY90 $366,449
	Computer Applications

"Models of Learning with a Computational Medium"

This project explores, develops and tests the educational possibilities of using an integrated, multi-functional computational medium that includes full programming capability. Boxer defines a high-powered work station environment for the personal and professional use of children, teachers, and curriculum developers of the 1990's. In a previous NSF grant, the project director established the scientific basis for such a system in a principled design, and she established the technological basis in a field-deployable implementation. Models of new kinds of educational practice in school settings that are made possible by such a medium will be developed and tested.

These models will highlight the new and special characteristics of Boxer that promise important changes in the ordering, content and form of school science. In particular, it will be demonstrated that Boxer is transparent, allowing students and teachers to get more quickly through the technical aspects of the system to basic mathematical and scientific learning, and that Boxer provides dramatic synergy in allowing easy combining of the various aspects of the system (text editing, data base capabilities, etc.), most particularly, synergy between programming and learning scientific principles.

Two new generalizable models of educational practice based on the use of a computational medium will be built. The first will teach about motion by developing a product-oriented community practice in the classroom. That practice will grow out of a carefully designed and integrated set of exercise microworlds, and its effectiveness in promoting deep conceptual change will be assessed by the capability of students to learn more on completion of the course. The second model will teach topics in fact-intensive sciences like biology by using the medium to display the hidden structure of knowledge in the domain, and by supporting learning and problem solving activities specifically appropriate to such domains.

PRIVATE SECTOR PARTNERSHIPS

Marjorie H. Gardner TPE 8851046
University of California Berkeley FY88 $228,505
Berkeley, CA Other NEC

"Industry Initiatives in Mathematics and Science (IISME) Academy Programs"

Through a Lawrence Hall sponsored partnership, 151 high school teachers from 35 school districts in the San Francisco Bay area have had summer jobs in 40 industrial firms. From these experiences these science, mathematics, and computer science teachers have carried a broader understanding of the applications of modern science and mathematics back into their classroom teaching. In 1986 an Industry Initiatives for Science and Mathematics Education Academy of Fellows was established to promote further exploitation of their industrial experience in Bay area classrooms. Through this project the Academy teachers will develop and test instructional materials based on their summer assignments in industry which they can use themselves and share with other teachers, explore ways to form an electronic network among themselves, and provide seminars which will carry university credit. The summer experiences in industry have already proven valuable, but this project will explore ways to enhance the value of such work experiences further through this variety of continuing activities.

Cost sharing by the partners will total 75% of the NSF funding.

TEACHER ENHANCEMENT PROGRAM

Marjorie H. Gardner TPE 8751778
University of California Berkeley FY88 $265,502
Berkeley, CA FY89 $275,425
Chemistry

"A Multidimensional Approach to Improving Chemical Education"

The Institute of Chemical Education (ICE) will offer three programs to address national needs and enhance chemistry teaching of different groups of teachers. The programs will be held at the Lawrence Hall of Science with the cooperation of the Department of Chemistry of the University of California, Berkeley. The three participant groups are (1) 36 underprepared chemistry teachers, primarily drawn from the underrepresented population in California who will be selected for the Fundamentals Program, (2) 20 experienced chemistry teachers selected nationally for the Instrumentation Program, and (3) 20 highly experienced, award-winning chemistry teachers chosen to participate in the Laboratory Leadership Program.

The Fundamentals Program is designed to update the content background and teaching strategies of needy teachers and will offer sequential four-week programs during two summers with appropriate follow-through activities planned for the intervening school year. This project design will allow time for teachers to integrate the body of knowledge and to maintain close contact with project staff.

The Instrumentation Program is a three-week program that will emphasize frontier areas of research in chemistry and the use of modern instrumentation as research tools. Participants will prepare materials to share with others and will construct some simple instrumentation for their own use.

The Laboratory Leadership Program continues an effort begun during the previous summer in which this very select group of teachers will identify the factors that influence use of the laboratory and develop means of assessing laboratory learning.

Forty percent of the cost of the project is shared by participants' school districts, the University, and individual staff contributions of time.

RESEARCH IN TEACHING AND LEARNING

Marjorie H. Gardner MDR 8751375
University of California Berkeley FY88 $116,316
Berkeley, CA FY89 $155,561
Mathematics

"The Families in FAMILY MATH: A Research Study"

The purpose of this research is to study the home processes related to children's interest and proficiency in mathematics, and to assess the extent to which these processes are changed through a program designed to help parents become more effective partners in their children's mathematics learning. The project will focus on families in FAMILY MATH programs across the country, specifically: low-income, inner-city minority and majority families in the San Francisco Bay Area; Hispanics (through Valle del Sol in Arizona); American Indians (through the Oregon Indian Education Association); and urban blacks (through the Urban League in Indianapolis, Indiana). Over 200 families will be included in the study.

Research questions posed for this study are: How does FAMILY MATH influence the parents' confidence and competence as partners in their children's learning? How does participation in the program change the families' math-related activities? Do parents increase their involvement in their children's formal mathematics learning? To what degree does participation in the program affect children's school mathematics learning?

The study has implications for future research on the factors influencing student achievement in mathematics, as it will help us understand how families can be an important resource in our efforts to improve student interest and competence in mathematics. Results will help us understand how home processes are different in special minority groups, what differences in patterns of change we might realistically expect when working with these special groups, and how programs might be modified to become more effective in communities where the children's needs for a "better chance" in mathematics education are particularly great.

NETWORKS PROGRAM

John L. Kelley	TPE 8550341
University of California Berkeley	FY85 $ 86,534
Berkeley, CA	FY86 $135,185
	FY87 $194,727
	Mathematics

"Family Math and Science: Linking Home and School"

This is a three-year project designed to: 1) disseminate the FAMILY MATH materials into five established regional minority networks across the United States; 2) provide training for parent and teacher leaders in these regional networks so they can plan and conduct their own FAMILY MATH classes; and 3) evaluate the effectiveness of these activities on students' mathematical literacy and school mathematics programs.

The following minority regional networks are involved in this project: The Council of Tribal Councils (Oregon); Valle del Sol (Phoenix, AZ); Navaho and Mescalero Tribal Councils (New Mexico), and the Urban League Chapters in Indianapolis, IN and Hartford, CT. Each of these groups is a subcontractor for this project and is responsible for the support of FAMILY MATH classes to be conducted by their parent and teacher leaders and the development of a detailed dissemination plan to reach most parents in their network.

NETWORKS PROGRAM

Robert C. Knott	TPE 8751768
University of California Berkeley	FY88 $186,411
Berkeley, CA	FY89 $184,163
	FY90 $ 51,680

"Great Explorations in Math and Science: Disseminating Activity-Based Science Nationwide"

The Lawrence Hall of Science will be launching with this grant a three-year dissemination effort designed to bring Great Explorations in Math and Science (GEMS), an activity-based science curriculum, into elementary and middle school classrooms nationwide, and to help determine the effectiveness of such a dissemination model. GEMS is a series of thirty teacher's guides to activities that are exciting and fun yet meet the content and process objectives of school-based science. GEMS activities have been extensively tested and improved by classroom teachers. They can be used to supplement or replace existing curricula, and require only easily accessible materials. Dissemination will be through orientation workshops to 2000 individual teachers and teacher educators across the nation who already implement activity-based materials in the class- rooms or who are interested in improving the teaching of elementary school science.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Lawrence F. Lowery	MDR 8751727
University of California Berkeley	FY88 $459,172
Berkeley, CA	FY89 $577,645
	FY90 $623,433
	Elem Science

"Full Option Science System - FOSS"

The Center for Multisensory Learning of the Lawrence Hall of Science, with this Full Option Science System (FOSS), will provide, for grades 3-6, a collection of multisensory, laboratory-based science activities. Some of these will be products of new development and some will be from the 1986 FOSS Pilot project, which received National Science Foundation funding. The FOSS Project will produce five products that will be developed with the cooperation of Ohaus Scale Corporation, which will bring the FOSS Program to the market after the third project year. The products will include sixteen modules of laboratory activities; a Materials Assembly Procedures document (to help teachers gather equipment for the activities); a set of correlation tables to assist with the integration of FOSS activities into frameworks, with textbooks, and with other hands-on resources; student laboratory equipment; and student worksheets and instruction sheets.

The Lawrence Hall of Science staff and will work closely with local school districts (including Mount Diablo and Vallejo Unified School Districts), and with the Ohaus Scale Corporation. Ohaus and other participants in the project will provide financial support in the amount of $2.4M.

TEACHER ENHANCEMENT PROGRAM

George C. Pimentel	TPE 8550045
University of California Berkeley	FY85 $196,790
Berkeley, CA	FY86 $249,199
	FY87 $261,335
	Junior HS Science

"Science for Science Teachers"

Fifty middle/junior high school science teachers will have the opportunity to participate in a program jointly sponsored by the Lawrence Hall of Science and the School of Education at the University of California at Berkeley. This month-long summer institute will take advantage of an unique and intellectually stimulating environment.

It is so designed that University professors and secondary school science teachers will become partners in the instruction of the participants.

This summer program will address the needs of middle/junior high teachers, their students, and the curriculum. A team of seven Teacher-Writers from middle and high school have been meeting for over a year, under the support of the University of California at Berkeley, designing laboratory activities and accompanying curriculum material for these grade levels. These materials will serve as the basis for the afternoon activities with lectures by prominent faculty from the UCB science departments providing the content necessary for a thorough understanding of underlying principles. Each of the four weeks is devoted to a specific discipline which is normally included in a middle/junior high curriculum. In addition, guest lecturers have been scheduled to present highlights of current research in their fields. Each of the laboratory projects written by the team of writers has been carefully designed to provide structure and flexibility for classroom use, and to encourage the development of scientific methodology among teachers and students. Both a teacher's version and a student's version of each project will be available for use. Materials necessary for the laboratory activities will be developed specifically by the equipment developer of Lawrence Hall. This kit of materials will become the property of the participants and their school at the conclusion of the summer. The projects include: Chemical Energy Lab, Mars, the Nature of Life, Communications Lab and Body Parameters Lab. Follow-up meetings for purposes of evaluation and support have been scheduled during the school year.

INSTRUCTIONAL MATERIALS DEVELOPMENT

George C. Pimentel	MDR 8652145
University of California Berkeley	FY87 $600,255
Berkeley, CA	Chemistry

"The Revision of the CHEM Study Films"

During the past twenty years, the twenty-seven CHEM study films have become classics among the chemistry films of the world. They were produced as an integral part of the Chemical Education Material Study and continue to be widely used. This is evidenced by the sale of more than 27,000 prints and more than 82,000 rentals since they were released in the early sixties. They maintain scientific integrity and are correlated to the texts currently in use. No other series of chemistry films has its subject matter authenticated by such outstanding chemists as Glenn T. Seaborg, Linus Pauling, Henry Eyring, Bryce Crawford, George Pimentel and J. Arthur Campbell. The films were produced for the high school level. The basics of chemistry, since they were produced, are still valid. They bring to the classroom demonstrations and abstract concepts in animated pictorial form which would be difficult for the teacher to present in any other way.

Unfortunately, teachers look at copyright dates and observe anachronisms of instrumentation, hair-styling and method of presentation and are deterred from using the films. Relatively minor revisions can bring them up-to-date at a modest cost compared with making new films. Revisions will include the use of modern instrumentation, discussions of current industrial uses for the concept, and the employment of underrepresented groups in film presentations. The useful life of these films can be significantly extended for some time. Since they can now be made available in low cost video cassettes, teachers will be able to have CHEM Study video materials available in every school. Without revision, these valuable teaching aids will be lost. Funding is provided for making these revisions.

TEACHER ENHANCEMENT PROGRAM

George C. Pimentel	TPE 8751763
University of California Berkeley	FY88 $251,653
Berkeley, CA	Junior HS Science

"Science for Science Teachers"

Science for Science Teachers features a four-week summer institute for 50 underprepared middle school/junior high school science teachers. The topics to be treated are representative of all the major science disciplines. There is a strong emphasis on laboratory experiences. The staff of the project include university research scientists and high school science teachers, all of whom have participated in similar programs during three previous years. Distinguished guest lecturers are used frequently. Instructional materials, both reading matter and laboratory apparatus, have been developed and tested in earlier years and are now available for use during the 1988 summer institute and in the classrooms of participants in subsequent years.

The participants are drawn from all parts of the United States. They maintain contacts with each other and with project staff through newsletters and reunions that are arranged in connection with National Science Teachers Association meetings. Strong group rapport has been characteristic of this project in previous years.

Costs of the project are shared by the Lawrence Hall of Science and the participants' home institutions. These contributions total 8% of the amount invested by the National Science Foundation.

INFORMAL SCIENCE EDUCATION

Richard Ponzio	MDR 8751462
Herbert D. Thier	FY88 $111,873
Laurel E. Dean	FY89 $ 92,379
University of California Berkeley	FY90 $ 57,228
Berkeley, CA	Informal Science

"Science Project for Informal Education"

A collaboration of staff from the University of California at Berkeley's Lawrence Hall of Science, School of Education, and the Cooperative Extension Service (4-H) will develop and implement SERIES (Science Experiences and Resources for Informal Education Settings), a state-wide informal science education program for the California State 4-H system. Over a three-year period they will adapt existing science curricula and generate new materials for use in informal 4-H settings around the theme of science relevant to societal concerns, with an agricultural technology focus. They will design and test a comprehensive training model using the materials to insure their effective use by volunteer leaders, and develop an extensive cadre of CES staff and volunteer trainers skilled in training volunteer teachers in the use of the curriculum materials.

The resulting curriculum and training materials will be published and made available at cost to all 4-H clubs. The project will directly benefit 100 paid and volunteer trainers, 1800 volunteer leaders and 12,600 youth participants, and will indirectly benefit the more than 60,000 youth enrolled in California 4-H programs each year.

RESEARCH IN TEACHING AND LEARNING

Frederick Reif	MDR 8550332
Alan H. Schoenfeld	FY86 $578,109
University of California Berkeley	FY87 $613,995
Berkeley, CA	Physics

"Principled Teaching of Scientific and Mathematical Concepts"

By engaging collaborating talent with complementary expertise (in physics, mathematics, and cognitive science), this research aims to develop effective methods for teaching scientific and mathematical concepts -- and thus to help overcome presently widespread learning difficulties. The methods are based on an analysis of the underlying knowledge components and thought processes required to make scientific or mathematical concepts flexibly usable -- and a comparative analysis of the thought patterns of novice students. They aim to teach separately, and then to integrate, each of the identified knowledge components (e.g., explicit interpretation procedures, intuitive knowledge, symbolic aids, error-prevention measures, metacognitive knowledge) by an explicitly specified instructional procedure. Observations of individual students under well-controlled conditions refine specific hypotheses about the importance of the identified knowledge components and teaching sequence. Some larger-scale assessments of teaching effectiveness will also be performed. The work should lead to principled and reliably effective methods for teaching a broad range of scientific and mathematical concepts, and to improved insights about the cognitive processes involved in scientific concept learning.

RESEARCH IN TEACHING AND LEARNING

Alan H. Schoenfeld	MDR 8751520
University of California Berkeley	FY87 $47,931
Berkeley, CA	Mathematics

"The Nature of Mathematical Thinking and Problem Solving"

Approximately twenty-five cognitive scientists, mathematicians, educators, and philosophers will meet for a three-day conference in the fall of 1988 that will be supported jointly with the Sloan Foundation. The conference will be held in an isolated setting (at a conference center, probably Pajaro Dunes) to promote the substantive, sustained interaction of the conference participants. To establish a context and some uniform background for the conference, conference participants will be mailed two "baseline" documents: the manuscript of Cognitive Science and Mathematics Education and the report "Establishing a Research Base for Science Education: Challenges, Trends and Recommendations". Two advisory boards, one for mathematics and one for cognitive science, will help select attendees and set the conference agenda. The mathematics advisory board consists of Ingram Olkin (Statistics, Stanford), Robert Osserman (Mathematics, Stanford), Henry Pollak (former vice president, Bell Communications Research), and Lynn Steen (Mathematics, St. Olaf); the cognition advisory board consists of James Greeno (Education and Psychology, Stanford), Lauren Resnick (Learning Research and Development Center, Pittsburgh), and Alan Schoenfeld (Education and Mathematics, Berkeley).

The advisory boards will frame key issues regarding mathematical understanding that they hope to see addressed by conference participants, including issues regarding a possible research agenda. The participants who prepare papers will be asked to write about those issues in such a way that (a) the papers are accessible to the broad range of participants, and (b) there is enough specific detail (research findings, examples of problems or instructional methods, etc.) to provide a base for substantive discussion. The papers will be mailed to the reactors a month before the meeting. The meeting will open with a general introduction. For the first two days of the conference, papers will be presented in one-hour sessions, with critiques and open discussion.

Readers for each paper will be chosen from a cross-section of the disciplines represented, to foster the kinds of interactions the conference is supposed to induce. The third day will be devoted to synthesis and an attempt to set a research agenda. Summary reaction talks will attempt to draw together various themes of the conference: identifying commonalities among the various perspectives, identifying points of controversy, and pointing to lines of communications among the various constituencies that might be pursued. A final session will focus directly on a proposed research agenda. What issues do the participants believe are a important and approachable? What do we need to know in order to make progress?

The conference will generate a number of papers which will be compiled as Conference Proceedings. The Proceedings will be edited by the members of the two advisory boards and published through a dissemination medium such as the Mathematical Association of America's MAA Notes series, or through a commercial publisher known for disseminating such work (e.g. Lawrence Eribaum). Presentations based on the results of the conference will be made at meetings of the American Educational Research Association, Mathematical Association of America, and National Council of Teachers of Mathematics.

RESEARCH IN TEACHING AND LEARNING

Alan H. Schoenfeld	MDR 8711342
University of California Berkeley	FY87 $46,237
Berkeley, CA	FY88 $50,787
	FY89 $54,115
	Mathematics

"Concepts and Meanings of Formal Domain"

This project will develop a scientific analysis of the knowledge and processes involved in understanding algebra at the high-school level. The research will use three main approaches: One approach is analysis of conceptual growth, a method that has been used productively in the study of cognitive development. The second approach uses tasks taken from the mathematics curriculum and related tasks designed to show what students are able to do and what knowledge they have that enables them to do it. The third approach uses methods of artificial intelligence to construct models of students' knowledge and cognitive processes.

The research will focus on students' understanding of the concepts of variables and functions and how this understanding relates to their knowledge of the symbolic expressions of algebra. The research on conceptual growth will study students' ability to reason about two physical systems involving functional relations, a winch in which the final position of a block depends on several factors, and a transfer of liquid from one cylinder to another, where the final height of liquid depends on several other factors. Previous research has shown that students have significant understanding of functions in these systems before they study algebra, and this research will document the increases in students' understanding as they study relevant formal mathematics. The research on understanding symbolic representations will study students' understanding of the meanings of formulas and graphs and their relations. Tasks used in these studies will include problems that are included in the curriculum, as well as more open-ended tasks designed to tap specific aspects of students' understanding. The research on computer modelling will use the results of the empirical studies to develop definite hypotheses about specific knowledge that students acquire in order to perform tasks in the curriculum and other reasoning tasks when they understand the concepts, and about the ways in which that understanding changes and grows.

Increased scientific knowledge about the understanding of concepts in algebra will contribute to our understanding of the domains of conceptual growth and the analysis of understanding the meanings of symbols. Previous research on conceptual growth has studied informal domains of knowledge, such as taxonomic categories and biological processes. This research will extend those analyses by studying algebra, a domain with a formal structure. Most previous studies of symbolic understanding have focused on ordinary language, and the study of understanding the formal system of algebra will provide new insights into ways that meanings of symbolic representations are understood. Results will also be useful in the improvement of school instruction in algebra and for other training in which mathematical understanding is important.

This project is funded jointly with the Directorate for Biological, Behavioral, and Social Sciences.

TEACHER ENHANCEMENT PROGRAM

Glenn T. Seaborg	TPE 8751459
University of California Berkeley	FY88 $246,167
Berkeley, CA	FY89 $281,973
	FY90 $241,579
	Mathematics

"EQUALS in Mathematics and Technology"

The project proposes to work with 116 teachers, including 96 teachers from six school districts in California and 2 each from ten other states. Each of the 20 teachers outside of California will in turn work with 100 other teachers in their states or districts. These are teachers at the middle school level, grades 3-8. The first year of the proposed three-year project emphasizes the adaptation of curriculum materials which were developed over the years by the proposed staff and their colleagues. The goal of the first year of the project is to assess the value of the materials to the participating teachers and their school districts. The second year focuses on developing a program to train trainers to use and adapt the materials in order to multiply the effect of the program. The third year continues with the development of the leadership activities and disseminates the course materials and instructional strategies beyond the targeted districts. There is an active follow-up component in each of the years.

There is to be eight days of concentrated instruction during each academic year and twelve days of instruction each summer.

This proposal contains several excellent attributes. It is to be conducted at an excellent academic institution; the PI, as the guiding force behind the proposed activities, is a world renowned scientist; the proposed staff have formed a community of scholars and are totally committed to the project goals; a very effective set of materials have been developed and improved over the years; the staff has been most successful in conducting workshops with the materials for teachers at the middle school level and above; as an extension of past efforts the team now intends to apply the materials and strategies at lower grade levels. Considering the outside contributions, beyond what is requested from the NSF, there is every indication that the project will receive support and attention from the educational and scientific communities and hence is worthy of the funding requested.

TEACHER ENHANCEMENT PROGRAM

Cary I. Sneider	TPE 8751779
University of California Berkeley	FY88 $141,099
Berkeley, CA	FY89 $354,908
	Astronomy

"Astronomy and Space Science Summer Institutes for Elementary and Middle School Teachers"

Astronomy and Space Science Summer Institutes for Elementary and Middle School Teachers is a twenty-four month program which will introduce fifty elementary and fifty middle school teachers whose school districts already own planetariums to experiences and resources for teaching astronomy and space science through classroom activities. Lawrence Hall of Science, in conjunction with New York Hall of Science, will conduct two three-week summer institutes and develop a series of Guides to the Active Planetarium to support teachers' efforts in conducting inservice workshops and fully utilizing planetariums to supplement classroom instruction. During the two-year period following the NSF funding cycle, participants will have follow-up meetings at major science teacher conferences with funds provided by Learning Technologies, makers of portable planetariums.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Herbert D. Thier	MDR 8751532
University of California Berkeley	FY88 $243,200
Berkeley, CA	FY89 $255,269
	FY90 $256,699
	Chemistry

"Chemical Education for Public Understanding Project"

The Chemical Education for Public Understanding Project (CEPUP) at the Lawrence Hall of Science will develop interdisciplinary materials for use at the middle/junior high school level to introduce students to chemicals and their importance in their lives. CEPUP materials will highlight areas of direct societal concern associated with science and technology. Students will be given chemistry based activities and experiments that focus on the environment, biotechnologies, industrial processes, agricultural practices, alternative energy sources and health science.

The CEPUP proposal is a three-year project to revise and field test the four modules produced during the pilot phase, and to develop and evaluate an additional twelve modules nationally. The project has maintained a strong cooperative working relationship with a variety of school systems and professional organizations and will work together with these groups and LAB-AIDS, Inc. to insure the long term widespread dissemination of the materials.

INFORMAL SCIENCE EDUCATION

Jennifer M. White	MDR 8751464
University of California Berkeley	FY87 $215,500
Berkeley, CA	FY88 $185,202
	Biology

"Within the Brain"

The Lawrence Hall of Science proposes to develop two 1400 square foot interactive exhibitions based on the latest research findings on the structure and function of the human brain; one for permanent display at the Hall, and one for circulation to 12 science museums over a five-year period. The exhibition will use large scale models and equipment from two television programs on the brain. Substantial input from scientists and psychologists will be combined with the educational expertise of curriculum development, museum, and design staff from the Lawrence Hall of Science to create the exhibitions. Visitor and school-related curriculum materials will be developed, including a video library and an auditorium show for large group school use.

The Lawrence Hall of Science has more than 300,000 visitors per year and is a major science education research and development facility; the twelve host museums will reflect museums in both large and medium-sized cities well distributed geographically. More than three million people will view the exhibits over a five-year period.

The re-use and relationship to a major television series, "The Brain", is an ingenious strategy and the Lawrence Hall of Science is matching the National Science Foundation contribution with comparable private funds.

YOUNG SCHOLARS

Victor A. Perkes	RCD 8755766
Kathleen M. Fisher	FY88 $52,257
University of California Davis	FY89 $52,257
Davis, CA	Life Science

"Interdisciplinary Program in Biological Sciences with Emphasis on Agricultural Sciences and Research"

The University of California, Davis conducts an interdisciplinary program in biological and environmental sciences with a focus on agricultural sciences. It combines a six-week summer program, with a school year follow-up endeavor for 11th and 12th grade students. The summer residential program combines instructional activities in areas selected as central to biological/agricultural disciplines with student research in a one-to-one relationship with university researchers. Research is an amalgam of students' individual interests and available institutional and personnel resources. Students receive close supervision and instruction on research design, reporting and the use of university resources.

The school-year follow-up program includes a) student presentation of research in the home school; b) a research update program on the UC Davis campus; c) student presentation of the research paper at the Science and Humanities Symposia of Northern and Southern California.

TEACHER ENHANCEMENT PROGRAM

Wendell H. Potter	TPE 8550162
Victor A. Perkes	FY86 $164,158
University of California Davis	FY87 $159,890
Davis, CA	HS Science

"UCD/Northern California Science Project for Pre-College Secondary Honors Teachers of Physical Science"

This Leadership Activities project will provide enhancement and professional development experiences for 40 exemplary secondary school physical science teachers from 15 counties throughout central and northern California. The overall goals of the multiyear project involve the updating and deepening of the participants' physical science backgrounds and teaching methodologies, the networking of the participants and university science faculty, the conduct of in-service workshops by the participants in their home schools, appropriate recognition for honors teacher participants, the dissemination of the project materials and results to nearby school systems, and the investigation of the modelistic approach within a carefully planned documentation, assessment and evaluation effort.

Selections of participants by a faculty and school committee will be based upon detailed applications requiring expressions of teacher and school commitments to implement project emphases. Working with university scientists, a full-time science curriculum specialist and four mentor teachers, the participants will complete a three-week summer workshop and monthly day-long meetings designed to increase their conceptual understanding of physical sciences, to develop strategies and materials for teaching thorough understanding of fundamental concepts and principles, and to develop materials and techniques for use in their presentation of in-service workshops. Participants will earn academic credits from the University of California, Davis. During the in-service workshops which the participants will design and conduct, the science curriculum specialist and other project staff will be available for consultation and support. Participants will be visited and observed in their classrooms and in their workshops with their peers. Careful documentation and analysis of these observations and of teacher reports will provide a significant basis for a detailed project evaluation.

TEACHER ENHANCEMENT PROGRAM

Wendell H. Potter	TPE 8751748
Victor A. Perkes	FY88 $153,728
University of California Davis	FY89 $160,699
Davis, CA	FY90 $113,122
	Physics

"Northern California Science Project - Middle Grades"

The Northern California Science Project-Middle Grades is a cooperative effort involving eight school districts in Central and Northern California and faculty and staff at the University of California, Davis. The project will involve twenty-four teachers (each year for two years) who regularly teach physical science to 7th and 8th grade students.

During years one and two, the project will concentrate on training the participants in teaching methodologies based on the constructivist theory of learning. All of the methodologies will be based on selected topics in physical science.

The first two years will see the teachers involved in a two-day spring workshop and a three-week summer institute. During the academic year following, the participants will be involved in five additional day long workshops at each of eight districts sites, and visits by the program staff to each teachers' classroom.

During the second and third years, emphasis will also be placed on documenting and assessing teachers' ability to use the teaching model in typical 7th and 8th grade settings and the effect of its use on the students conceptual understanding of selected physical science concepts.

The University of California, Davis and the school districts have contributed an amount equal to 25% of the NSF award.

TEACHER ENHANCEMENT PROGRAM

Juan F. Lara TPE 8751329
University of California Los Angeles FY88 $212,057
Los Angeles, CA Biology

"Project for Leadership Enhancement, Application, and Dissemination in Science (LEADS)"

The Project for Leadership Enhancement, Application, and Dissemination in Science (LEADS) will educate twenty excellent teachers of science (called primary leaders) to lead workshops for sixty selected qualified elementary teachers (called secondary leaders) and twenty administrators who will go back to Los Angeles area school districts to lead science education programs they helped design. Beginning in January 1988, primary leaders will attend ten sessions of training, developing a handbook and workshops. In the summer of 1988, school districts will nominate teams of three elementary science teachers and an administrator that will attend a four-week workshop in biology, earth science, chemistry and physics at UCLA with lectures by scientists on the staff of the University. The primary leaders will run the workshops and perfect the handbook. In the 1988-89 academic year, the school districts will arrange workshops for their science teachers using the secondary leaders.

Robert J. Strangeway RCD 8708079
University of California Los Angeles FY87 $16,000
Los Angeles, CA Atmospheric

"Applications for Fellowships to the Third International School of Space Simulations"

This grant will provide partial support for fifteen students and young researchers to attend the Third International School for Space Simulations to be held in La Londe-les-Maures and Beaulieu, France from June 15 to 27, 1987. The school will include both tutorials on the use and development of simulation codes and presentations of the most recent research carried out in space plasma physics with the aid of computer simulations. The school will be of particular benefit for young researchers, both in terms of gaining experience in simulations, and in the opportunity to interact closely with experts in the field. Since the meeting will also be attended by European and Japanese scientists, the recipients of fellowships will be able to develop important contacts with the international research community, which should be of considerable benefit in the future.

The major objective of this grant is educational. Two previous schools have been supported by NSF with great success and have helped establish a U.S. pre-eminence in the area of S/T simulations. A second objective is that of advanced code development. Modelling of the S/T environment requires sophisticated code development of 3rd plasma simulations in realistic geomagnetic field geometries. This is a difficult problem relying partly on advances in numerical techniques e.g. adaptive grids. Finally this effort will lead to advances in modelling the S/T system.

This project is funded jointly with the Directorate for Geosciences and the Directorate for Computer and Information Science and Engineering.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Noreen Webb MDR 8751309
University of California Los Angeles FY88 $120,427
Los Angeles, CA FY89 $128,750
Mathematics

"Promoting Problem-Solving Skills in Middle School Mathematics"

This project responds to increasing national concern about the low levels of participation and achievement of inquiry skills among women and non-Asian minorities in mathematics. Activities will include the design of an instructional approach that combines an inquiry-based mathematics curriculum with cooperative small-group learning. It will test the effects of the combined instructional approach on the mathematics achievement, attitudes, and future plans of low-income Hispanic middle school students. The major focus will be on students' abilities to solve problems in mathematics and their participation in classroom problem-solving activities.

The project will be carried out in three phases: (1) the effects of inquiry-based instruction on development of inquiry skills will be tested; (2) a cooperative learning component will be added to classroom activities; and (3) students will be trained to increase their involvement and participation in classroom activities.

The results of this project will be significant in a number of ways: it is the first attempt to design and systematically test combined inquiry-based and cooperative learning approaches to mathematics curricula and instruction; it has the potential of creating more optimal learning opportunities for low socioeconomic Hispanic students; it has potential for improving the inquiry skills of all students; the intervention strategies to be developed have potential for motivating students to continue their education in mathematics and the sciences.

TEACHER ENHANCEMENT PROGRAM

Paul D. Saltman TPE 8751679
Robert A. Dean FY88 $313,722
University of California San Diego FY90 $307,230
San Diego, CA FY91 $319,582
Biology

"UCSD Science Teacher Institute for Elementary Science Teachers"

This project involves a partnership among San Diego County Schools, the University of California at San Diego, and industry to improve the quality of science instruction at the elementary (K-6) school level. The program will span a three-year period and encompass a five-week on-campus summer institute during each year of the program as well as a series of 8 meetings during the academic school year.

Year One of the program will emphasize the life sciences, Year Two earth and environmental sciences, and Year Three the physical sciences. An attempt will be made to integrate all science content areas with each other and with reading and mathematics.

The major goal of the project is to educate 100 Resource/Mentor Teachers who will return to their schools and provide inservice programs in science content and methodology. Commitments to participate in the program have been received from 27 school districts.

This project is of particular interest to the Teacher Enhancement Program in that it is county-wide and involves all segments of the community in a cooperative effort to begin improving the system at the elementary level.

TEACHER ENHANCEMENT PROGRAM

Marvin Marcus TPE 8652333
John L. Bruno FY87 $516,999
Univ of California Santa Barbara Computer Science
Santa Barbara, CA

"Computing and Algorithmic Mathematics for Secondary School Teachers"

This national leadership project offering superior computer science/mathematics instruction for high school mathematics/science teachers combines two six-week intensive summer sessions on Pascal and algorithmic mathematics with individualized guided home study operation and a two-day meeting at mid-year during the intervening academic year. The participating teachers will run in-service workshops/seminars for their schools upon completion of the program.

The goals of the project are to assist high school teachers to:

- be proficient in teaching the essence of computer science, namely the construction and testing of algorithms;
- experience intensive supervised hands-on instruction;
- become lead teachers and run workshops for their school districts;

The first summer (1987) 60 teachers, half from California and half from a national applicant pool, with various demographic and ethnic backgrounds, will meet at the University of California, Santa Barbara. They will study: structured programming in Pascal; data structures in Pascal; and algorithmic mathematics. During the intervening academic year, there will be a nine-month program of guided home study under the direction of project faculty and staff via a hot line telephone, mail-in assignments and a mid-year mini-conference at the UCSB microcomputer laboratory. The next summer (1988) the same 60 teachers will return to UCSB to study: computer systems; programming language organization and implementation; and topics in algorithmic mathematics. The teachers will also take seminars on how to develop computer workshops for colleagues in their school districts, and how to translate their course work into materials for class use.

The project director is Marvin Marcus, professor of mathematics and computer science and a vice-chancellor at UCSB. Marcus is recognized internationally for his work in the mathematical sciences. The senior personnel will consist of Ralph Shively, professor and chairman of the department of mathematics and computer science at Lake Forest College, senior mathematical scientists, a research learning expert, and evaluators from UCSB and Lake Forest. Cost sharing by UCSB consists of paying the administrative costs of the director of university extensions, and exclusive use of the micro-computer laboratory.

TEACHER ENHANCEMENT PROGRAM

Marvin Marcus TPE 8751678
John L. Bruno FY88 $509,560
Richard E. Mayer Mathematics
University of California Santa Barbara
Santa Barbara, CA

"A National Institute for Secondary School Teachers for the Dissemination of Computer Science and Algorithmic Mathematics"

The main goals of the project are to offer intensive instruction in computing and algorithmic mathematics to sixty secondary school teachers and to help them in extending the ideas and knowledge obtained in the project to many more teachers in their respective school districts. This is to take place over a period of two summer sessions along with an individualized, guided home study program during the intervening academic year when the participants are to extend the subject matter presented in the first summer session. The participants are to maintain close written and telephone contact with the project faculty and staff to help the participants implement the new ideas in their schools. Additional follow-up activity during the year includes a two-day miniconference to discuss the teaching of computer science and algorithmic mathematics and to provide the participants with intensive, supervised, hands-on instruction. There is to be widespread dissemination activities of the project activities to reach a wider audience extending the direct contact with the 60 initial participants. There is to be academic credit at the undergraduate level as well as the post graduate level equivalent to 20 upper division quarter hours.

TEACHER ENHANCEMENT PROGRAM

Julian Weissglass TPE 8550283
Univ of California Santa Barbara FY86 $349,606
Santa Barbara, CA FY87 $349,479
FY88 $369,741
Mathematics

"Improving Mathematics Education Through Site-Based Change"

The University of California, Santa Barbara, will develop and implement classroom curricula, both content and methods of instruction, through site-based change over a period of three years. During the first year, the project will initially involve seven schools from Ventura and Santa Barbara Counties. This will be expanded to 13 in year two and to a total of 19 schools in the third year. Teaching specialists, classroom teachers who have been selected and trained to act as resource persons and trainers for their colleagues, will serve for one year on a rotating basis.

The project provides an opportunity for administrators, parents, the community and teachers to work together. It provides training and ongoing support for a cadre of teachers, to develop methods that assess student understanding. The activities of the Tri-County Mathematics Project and the UCLA Partnership have been incorporated in the project. Much of the in-school activities will be carried out during one released day each month and six hours per month of after-school meetings.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Ronald W. Henderson MDR 8550386
University of California Santa Cruz FY86 $103,524
Santa Cruz, CA FY88 $ 20,705
Life Science

"Life Lab Elementary Science Program: Curriculum Development and Field-Testing"

The "Life Lab Elementary Science Program" has produced some quality instructional materials employing scientific aspects of growing and nurturing plants. The materials have been well accepted by the elementary teacher community. These materials will provide the base upon which a much larger development effort will take place in cooperation with large school districts and a publisher. This supplemental award will insure that the prototype products be validated.

COLLEGE SCIENCE INSTRUMENTATION

Jay H. Jones USE 8853138
University of La Verne FY88 $17,041
La Verne, CA Chemistry

"Enhanced Instrumentation for Undergraduate Instruction in Environmental Chemistry"

The addition of two items for the central instrument facility: 1) a purge and trap system, and 2) a high performance liquid chromatograph, provides full support for the current instruction in the environmental sciences and substantial support for an environmental engineering program. The additional instruments augment those already available and provide all the major instrumentation needed for up-to-date instruction in the Environmental Chemistry component of the environmental programs. The augmented instrumentation supports specified EPA methodology and the development of novel methods for environmental analysis.

The grantee provides funds for this project that are an equal match for the NSF award.

YOUNG SCHOLARS

Michael J. Minch RCD 8850100
University of the Pacific FY88 $54,385
Stockton, CA FY89 $54,385
Biology

"High School Summer Honors Program on Genetic Engineering"

The University of the Pacific offers twenty-five students a three-week intensive residential lecture and laboratory course on genetic engineering. There is a strong emphasis on the laboratory methods of modern molecular biology, as well as the career opportunities resulting from this new technology. Students are exposed to the ethical and social issues associated with this technology. Participants are entering seniors in high school. Six of the fifteen participants continue working full time in the biochemical research laboratory of the Principal Investigator for an additional five weeks.

COLLEGE SCIENCE INSTRUMENTATION

Stanley D. Nel USE 8852453
University of San Francisco FY88 $42,897
San Francisco, CA Mathematics

"An Applied Mathematics Computing Laboratory"

Using the tools of practicing applied mathematicians - symbolic mathematics, numerical analysis and graphics packages - the faculty will restructure the teaching of Calculus, Linear Algebra, and

Differential Equations. The project will apply the successful philosophy and strategies of the department's Applied Mathematics Laboratory to undergraduate mathematics courses. The laboratory sessions will focus on applications and not programming. Students will work on a team solving applied mathematics problems posed by local industry. Replicability will be accomplished through publication of the software packages and problems.

The grantee is providing an equal sum for the equipment obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Denny Burzynski	USE 8852707
West Valley College	FY88 $49,724
Saratoga, CA	Mathematics

"Innovative Curriculum Applications in the Community College Mathematics Classroom"

This project will move the College's successful prior efforts in the computerization of the curriculum into a more advanced stage. The mathematics faculty members have been forward looking in their extensive use of the previously available computing devices in their instructional program. They are now ready to undertake an expansion that will incorporate important new technologies, i.e., computer graphics and symbolic algebra systems.

The grantee is providing an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Alfred W. Hanson	USE 8750389
Whittier College	FY87 $11,833
Whittier, CA	Biology

"Microcomputer-Assisted Laboratory Stations for Undergraduate Physiology Courses"

Five highly versatile microcomputer-assisted laboratory stations are being used in nine different courses within three academic departments to modernize undergraduate instruction in physiology. The instrumentation includes Apple II GS microcomputers, Apple Imagewriter II printers, Harvard/SRI stimulators, and six different physiological data acquisition systems for each station. Stations thus equipped collect, display and print the data from a variety of physiological experiments including those in spirometry, cardiography, muscle contraction, reflex function, skin responses, and biofeedback. The use of these microcomputer-aided instruments permits a wide range of laboratory activities at approximately 60% of the cost of traditional recording devices. In addition, elatively inexpensive programs can be added for simulations and autotutorials dealing with such specific processes as intermediary metabolism, cardiovascular fitness, nutrition and renal function. The completed stations are providing the students with a unique opportunity to further their understanding of the methods of obtaining experimental data. It also allows them to develop skills involved in the analysis and interpretation of such data. Finally, it exposes them to wide variety of experiences at a reasonable cost.

COLLEGE SCIENCE INSTRUMENTATION

Joyce P. Kaufman	USE 8750465
Whittier College	FY87 $15,008
Whittier, CA	Political Science

"Computer Simulated Negotiation in a Cross-Cultural Context"

As social scientists the laboratory is the world and the best approximation and understanding of the ways in which nations operate is through representative experiments such as simulations. Simulation as a technique for teaching and learning is an integral part of the Political Science curriculum. However, the simulations were based on human interaction and simple forms of communication. The project is enabling the college through the addition of computers, printers, modems, and support equipment to become a full participant in the International Negotiation Project, which is a simulation of foreign policy decision making that relies on computer technology for communication between member institutions. The simulation is unique and of special interest because institutions around the world routinely participate and communicate in their native tongue. This helps stress problems of decision making while also addressing issues of cross-cultural communication and problems of translation.

COLLEGE SCIENCE INSTRUMENTATION

Dallas D. Rhodes	USE 8750314
Whittier College	FY87 $14,200
Whittier, CA	Multidisciplinary

"Photographic Image Analysis by Undergraduates in the Natural and Social Sciences"

The project will provide students in the natural and social sciences with experience in detailed image analysis. The instrumentation will allow Whittier College to make full instructional use of the Fairchild Aerial Photography Collection--a unique archive of historical (1928-1964) aerial photographs. Because of the age and breadth of photography in the collection, both major and non-major students in several disciplines can use it for laboratory, class, and research projects. Geology students will use aerial photographs and maps to show the progress of natural processes and analyze geological features. Students in biology will be able to map vegetation, habitats, or particular environments and show how they have changed in response to natural events (e.g., fire) and changing land use. Sociology classes will analyze processes of urban development and the distribution of social and ethnic groups in terms of their geographic location in the natural and man-made landscape. The major piece of equipment to be purchased is a Bausch & Lomb Zoom Transfer Stereoscope. This instrument allows all types of images to be compared by carefully matching scales and removing distortions, and information on an image can be transferred to special-purpose maps. A digitizer tablet with appropriate software and a computer will be used to convert the graphical data to numerical form for image and statistical analyses.

COLLEGE SCIENCE INSTRUMENTATION

Raymond Smith USE 8851727
Whittier College FY88 $13,813
Whittier, CA Mathematics

"Computer Based Instruction in Mathematics"

Computer applications will be added to the Calculus and Mathematics for the Liberal Arts courses.

Calculus students will use the graphing, symbol manipulation, numerical calculation capabilities of Macintosh computers to better understand the concepts of Calculus. The redesigning of the Mathematics for Liberal Arts course will center on the use of mathematics and computers in real world situations.

The grantee is providing an equal sum for the equipment obtained from non-Federal sources.

COLORADO

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Althea G. Pearlman
Mathematics
Boulder High School
Boulder, CO

Edward L. Waterman
Science
Rocky Mountain High School
Fort Collins, CO

1988

Barbara Pond
Mathematics
Parker Junior High School
Parker, CO

Bruce Hogue
Science
Dunstan Junior High School
Lakewood, CO

CAREER ACCESS OPPORTUNITIES

Suzanne Benally	USE 8850674
American Indian Science and Engineering Society (AISES)	FY88 $104,028
Boulder, CO	Other NEC

"Increasing Career Access Opportunities for American Indians in Science and Technology"

The strategy underlying this project is called "near peer" counseling and mentoring. The American Indian Science and Engineering Society (AISES) is establishing a networking model to improve the access of American Indian students to careers in science and technology. The model, cooperatively developed with Montana State University, Northern Arizona University, Clarkson University, the University of New Mexico and New Mexico Institute of Mining and Technology will be implemented over a two year period. AISES student chapters at those institutions are the major vehicle in implementing the network and conducting the activities. One of the major accomplishments of AISES has been in sponsoring the establishment of undergraduate student chapters at some 40 colleges and universities around the country. These have played an important role in improving the retention rate of American Indian undergraduate students on those campuses.

Project activities during the first year involve mentoring, role modeling, motivating and encouraging American Indian high school students through science and mathematics activities conducted by selected members of each chapter. After appropriate preparation and training by faculty during the first semester, these chapter members make regular second semester visits, initially accompanied by their chapter faculty sponsor, to five predominantly American Indian high schools in the region. They conduct special labs, lead field trips, and hold counseling sessions for students as well as special sessions for parents, teachers, extended family, tribal leaders and school board members. The Indian high school students and their parents are also invited to visit the AISES campus chapters to sit in on university classes and witness a typical day in the life of an American Indian student majoring in science or engineering.

During the second year, following a similar schedule, new AISES chapter counselors will be trained and will then repeat the previous year's activities with a new group of high schools and students. At the same time, selected members of the high school students impacted the first year will be trained as counselors for similar activities in elementary and junior high schools serving American Indian students. A computerized tracking system linking AISES, the participating universities and AISES chapters, and the schools into a network for monitoring and evaluation will be established.

TEACHER ENHANCEMENT PROGRAM

Norbert S. Hill, Jr.	TPE 8751242
American Indian Science and Engineering Society (AISES)	FY87 $152,344 FY88 $210,376
Boulder, CO	FY89 $123,096
	Middle School Science

"American Indian Schools: Science Teacher Development"

American Indian Schools: Science Teacher Development, organized under the direction of the American Indian Science and Engineering Society, will enhance the general science background of 40 teachers, grades 5-8, from schools in which the majority of the students are American Indians. Over a three-year period, teachers will develop and test classroom materials which interface science and the culture/tradition of American Indians.

In the first four-week summer workshop, 20 teachers attended a program at the Colorado School of Mines, studied general science, met and learned from prominent American Indian Scientists, and developed draft materials employing cultural integration in science. These were tested and evaluated during the first academic year of the project. The participants will return for a second four-week summer program with 20 additional teachers. After refining the classroom materials the teachers will all use and evaluate the refined draft edition in the academic year. During the third summer 10 teachers will return to revise the volume of lesson plans and prepare it for distribution, through AISES, to teachers in 1200 American Indian Schools.

If American Indians are to realize increased participation in key scientific and technical positions, programs must be developed that significantly enhance the opportunity for American Indian youth to have high quality mathematics and science preparation. Increasing the knowledge and motivation of teachers is the best means of delivering more knowledgeable students to college. This is critical to enlarging the pool of students eligible to participate in mathematical and scientific fields.

YOUNG SCHOLARS

Norbert S. Hill, Jr.	RCD 8850262
Catherine Abeita	FY88 $51,708
American Indian Science and Engineering Society (AISES)	FY89 $51,708
Boulder, CO	Mathematics

"American Indian Summer-Math Scholars Network"

The American Indian Science & Engineering Society (AISES) conducts a three-week summer residential math camp for 30 American Indian junior high school students entering grades 8, 9 and 10. The goal is to help students strengthen their skills in algebra, geometry, trigonometry, and pre-calculus in order to facilitate their entry into math-based disciplines at the collegiate level. The math camp is a prototype program which will be replicated nationwide in both urban and rural areas, and will be used to leverage 10 additional multi-tribe summer math camps during the next three years.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Rodger W. Bybee	MDR 8652131
Biological Sciences Curriculum Study	FY87 $639,198
Colorado Springs, CO	FY88 $862,756
	FY89 $729,546
	FY90 $635,388
	Elem Science

"Elementary School Science and Health Materials"

The Biological Sciences Curriculum Study (BSCS) will design, develop, and evaluate a K-6 science/health program that will incorporate proven implementation strategies. The areas of discipline concentration will be equally divided among the life, health, earth, and physical sciences. The program will complement goals of science knowledge and processes with emphases on personal/social goals, problem solving, decision making, and technology.

Project staff will use the appropriate results of research in the cognitive sciences to revise and develop materials. The results of research on implementation strategies will be applied when developing materials for teachers and administrators, and in designing activities that promote use of the new program. Implementation efforts are central to this project.

Project outcomes will include: 28 activity-based student modules for a complete K-6 science/health program; teachers' guides and computer software for program management; implementation guides; and supplementary activities integrating science with reading, language arts, and mathematics.

Kendall/Hunt Publishing Company is collaborating with BSCS in the development and implementation of this science/health program. The publishers will invest in excess of $2.9M during the 4-year development phase, and will continue teacher development activities in subsequent years. Private foundations as well as the Colorado Springs School District are also contributing to development and testing activities.

TEACHER ENHANCEMENT PROGRAM

James D. Ellis	TPE 8650174
Biological Sciences Curriculum Study	FY86 $ 93,616
Colorado Springs, CO	FY87 $130,764
	FY88 $134,566
	Computers

"A Model for Teacher Enhancement in Educational Computing in the Sciences"

This three-year project will have trained science teachers and administrators in the Pikes Peak region to use the computer to enhance learning/teaching. Upon completion of year three, district leaders should be fully trained to prepare and supervise science teachers in educational computing. The task of maintaining the teacher preparation activities will be assumed by these leaders with support from their districts.

During year three, the project staff will concentrate on evaluating the effectiveness of this teacher preparation model, and establishing a self-sustaining teacher preparation network in the Pikes Peak region. Networking will include establishing advisory committees on educational computing in the sciences within each district to study and make recommendations for educational computing, and a committee for the Pikes Peak region to facilitate interactions among cooperating districts.

This project can serve as a national guide for preparation of science teachers to use computers effectively in the classroom.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Joseph D. McInerney	MDR 8744762
Biological Sciences Curriculum Study	FY87 $3.645
Colorado Springs, CO	Biology

"Advances in Immunology and Immunogenetics: Development and Distribution of an Instructional Monograph For High School Teachers and Students"

Over the past decade, there have been significant advances in our understanding of how the human immune system functions. Advances in molecular genetics have led to a deeper understanding of the genetic control of immune response, and are currently leading to an expansion of our knowledge of the relationship between genes and certain human cancers. But knowledge of these conceptual advances in biology and of the health-related applications has not yet filtered into the high school curriculum. In this project, the Biological Sciences Curriculum Study, in conjunction with the Foundation for Blood Research, will develop, field test, and distribute an instructional monograph on advances in immunology and immunogenetics for use by high school teachers and students. The first half of the monograph will be devoted to an update for teachers and to suggestions for introducing immunology content into the existing secondary school biology curriculum. The second half will be devoted to classroom activities.

The monograph will be distributed by the National Association of Biology Teachers to its 6000 members and by the National Center for Education in Maternal and Child Health to others on a per-request basis.

COLLEGE SCIENCE INSTRUMENTATION

Nathan W. Bower	USE 8750040
Colorado College	FY87 $25,830
Colorado Springs, CO	Chemistry

"Integrated Chemometrics Program for the Undergraduate Curriculum"

Chemometrics has been defined as the field in which mathematical and statistical techniques are used to extract valuable, but often hidden, information from measurements. Its introduction into the undergraduate curriculum has been recommended by the American Chemical Society. The Chemistry Department at Colorado College is implementing the introduction of chemometrics into the undergraduate curriculum through the recent acquisition of a Fourier Transform Infrared Spectrometer with selected spectral libraries and an enhanced library search package attachments. In addition to the usual infrared spectroscopy activities, use of this system is providing students with experiences in fourier transforms and computerized spectral searches. The courses impacted include organic chemistry, quantitative analysis, advanced analytical topics, reaction mechanisms and syntheses, theoretical spectroscopy, and research participation.

YOUNG SCHOLARS

Eiler L. Henrickson	RCD 8850006
Daniel D. Schultz-Ela	FY88 $66,770
Colorado College	FY89 $66,770
Colorado Springs, CO	Environmental

"Outdoor Seminar in Geology for Young Scholars"

An eight-week field-oriented geology course for 16 high school students is based at Colorado College in Colorado Springs. The course teaches students to apply scientific principles to actual geological problems in a stimulating outdoor environment, emphasizing the approach and methods a professional geologist would use. Hands-on experiential learning in classical geological areas of the west replaces classroom lectures and labs. More than 80% of class time is spent in the field. Cognate sciences are employed to demonstrate the interdisciplinary nature of geology and promote further interest in their pursuit. Students learn to make informed, reasoned, ethical judgement about environmental and resource issues. Tours of government and industry facilities expose students to career choices and employment opportunities in the sciences. The intensive, yet informal nature of the course fosters professional interchange of ideas, which are presented orally and in written reports. The staff are all experienced field geologists with backgrounds in the liberal arts approach to learning. Outstanding women and minority paraprofessionals encourages mentoring with leaders underrepresented in the field.

TEACHER ENHANCEMENT PROGRAM

Thomas R. Wildeman	TPE 8751454
John U. Trefny	FY88 $165,640
Colorado School of Mines	Other NEC
Golden, CO	

"Teacher Enhancement Through Experiential Courses"

Teacher Enhancement Through Experiential Courses is a two-year series as pilot workshops for K-12 teachers in Colorado. The one credit in-service programs will combine problem-solving approaches to real-life situations outside of the traditional classroom. They will incorporate curriculum development, in- school trials, and the sharing of results in follow-up sessions. They will lead to the development of "master teachers" and a networking among teachers and various resource people and facilities in the region.

COURSE AND CURRICULUM

Richard Yeatts	USE 8813784
Joan Hundhausen	FY88 $74,517
Colorado School of Mines	FY89 $47,451
Golden, CO	FY90 $84,753
	Mathematics

"An Integrated Program in Calculus and Physics"

A physicist and mathematician at Colorado School of Mines will combine efforts to develop and test an integrated Calculus and Physics course. A unique feature will be well-planned laboratory/workshops session where much of the integration of the subject matter will occur.

These sessions will provide students with the opportunity to explore and discover the relationships between a physical situation, its graphical or geometric representation and the corresponding analytical representation. The workshop exercises will consist of physics experiments, numerical simulations, symbolic manipulations, computer programming and formal reasoning exercises.

Study guides, problem sets and modular materials will be developed. The modules will be self-contained. There will be internal and longitudinal evaluation of students' progress, as well as external review of a National Advisory Committee.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

YOUNG SCHOLARS

Jack R. Fenwick	RCD 8850134
D.Rae Wilkinson	FY88 $65,068
Kenneth G. Doxtader	FY89 $65,068
Colorado State University	Life Science
Fort Collins, CO	

"Colorado State University Young Scholars Program"

This Young Scholars project is designed to provide high ability and high potential secondary students with the opportunity to learn about careers in plant and soil sciences. Specific objectives are to (1) provide hands-on experience in a research laboratory; (2) utilize research scientists as role models for young scholars; (3) inform students about research methods and ethical issues associated with research; and (4) provide information about career planning, development and opportunities.

Twenty young scholars between their junior and senior years in high school participate in the 6-week summer program. Colorado State University faculty members and cooperating scientists deliver lectures, lead discussions, conduct field trips, and provide students with research experiences. Disciplines involved in this program include agronomy (crop and soil sciences), botany, genetics, horticulture, range science, forestry, microbiology, plant pathology and entomology.

INFORMAL SCIENCE EDUCATION

Karen S. Hollweg	MDR 8550164
John C. Emerick	FY85 $57,900
Denver Audubon Society	FY86 $95,759
Denver, CO	FY88 $14,930
	Biology

"Volunteers Teaching Children: Denver Audubon Society's Urban Education Project"

This supplement to the Denver Audubon Society's Urban Education Project will allow staff to meet with and to train project sponsors in six cities nationwide that are considering adopting the project's model of a volunteer-based outdoor biology education program.

INFORMAL SCIENCE EDUCATION

Karen S. Hollweg	MDR 8850604
Denver Audubon Society	FY88 $383,039
Denver, CO	Ecology

"Dissemination of Denver Audubon Society's Urban Education Project"

The Denver Audubon Society will, over a three-year period, provide the training and materials necessary to disseminate their Urban Education Project to six or more cities across the country. Their outdoor education program is "hands-on," locally supported with funds and volunteers, and targeted to include inner-city children who will be served in locales close to their homes and schools.

NSF funding will support project staff, provide initial curriculum materials, and insure close contact with the developing programs. About 20,000 elementary children and nearly a thousand adult volunteer leaders will participate in the program over the three-year period. At the end of the project, the new programs will continue without further assistance, and will serve as models for other community programs. Over the three-year project period, more than $380,000 in local funds and in-kind support will be provided, nearly equalling the NSF support.

Participating cities include: Boston, MA; Louisville, KY; Birmingham, AL; Prescott, AZ; Arlington, TX; Gainesville, FL; Seattle, WA; and Broward County, FL.

STUDIES AND ANALYSES

Jane M. Armstrong	OSPA 8650060
Education Commission of the States	FY86 $115,558
Denver, CO	FY88 $ 16,981
	Other NEC

"State Strategies to Support Science and Mathematics Curriculum and Assessment Development at the School and District Level"

This FY88 supplement to a grant to the Education Commission of the States (ECS) is to study three policy-related questions concerning the impact of state reforms in precollege math and science on schools and school districts. The three questions are:

1. What are effective strategies at the state level that will improve curriculum content through the use and articulation of state curriculum standards, the selection of instructional materials and student assessment?
2. Under what conditions does state action on curriculum standards, instructional materials and assessment work effectively to support improved curriculum content in schools and districts?
3. How do these strategies define the role and responsibility of the state education agency (SEA) in improving the quality of curriculum?

Three states will be studied to allow ECS to identify several effective strategies and make comparisons among states selected for their varying degrees of state initiatives in curriculum and assessment and degree of "state control."

FACULTY ENHANCEMENT PROGRAM

Gary W. Grefsrud	USE 8854223
Fort Lewis College	FY88 $24,681
Durango, CO	Mathematics

"Short Course for Undergraduate College Teachers on Mathematical Modeling"

In order to encourage a greater percentage of talented students to pursue careers in mathematics, the physical sciences, and engineering, college teachers must be knowledgeable in the applications of Mathematics and recent developments which should be incorporated into the undergraduate curriculum. Instruction to college teachers of mathematics through summer short courses and workshops has proven to be one mechanism to accomplish these goals.

A week-long short course will be conducted for undergraduate college teachers of mathematics on the topic of Mathematical Modeling. The objectives of the short course are to provide college teachers in the mathematical sciences with the knowledge necessary to supplement existing courses with mathematical models, develop mathematical modeling courses at their home institutions, and educate colleagues through seminars and workshops. There will be twelve hours of in-class instruction on models suitable for undergraduate students together with the associate pedagogy. There will be an additional six hours of in- class discussion in which specific mathematical models will be developed and participant assignments will be discussed. Computers and associated software will be used by the instructors and students in the development and solution of models.

In addition to NSF support, participants will contribute about 15% in travel costs, and staff will contribute another 15% of their time.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Harold Pratt	MDR 8550202
Jefferson County Public Schools	FY86 $190,032
Lakewood, CO	FY87 $227,708
	FY88 $262,624
	Biology

"Junior High/Middle School Life Science Program"

The Jefferson County Public School System is developing a year-long junior high/middle school program in life science with emphasis on the understanding and care of the human body. The development will be done in close cooperation with the University of Colorado Health Sciences Center and with the support of local physicians and university-level scientists and science educators. The program will provide an alternative for teachers and schools seeking materials to improve their life science curricula and will serve as a resource for schools seeking to integrate health topics with their existing life science course. A part of the program will also direct students toward an ability to make decisions in and about their local environment. Provisions have been made to develop a variety of materials for this portion of the course that will fit local environments, i.e., a variety of ecosystems across the country. A text integrating reading activities, laboratory activities, and student questions along with a supporting teacher's guide will be produced.

The Jefferson County Public Schools will be joined in their effort by The NETWORK, Inc. of Andover, Massachusetts. The role of The NETWORK is to create a strong training and support system for the course materials, evaluate their effectiveness, and disseminate the materials on a national basis.

COLLEGE SCIENCE INSTRUMENTATION

Jack D. Cummins	USE 8851884
Metropolitan State College	FY88 $36,373
Denver, CO	Chemistry

"Utilization of Gas Chromatograph/Mass Spectroscopy by Undergraduates"

A Hewlett Packard Gas Chromatograph/Mass Spectrometer is being purchased for the use in five areas of Chemistry. By teaching the principles and operation of a modern microprocessor driven separation and identification technique, students are learning chemical principles as well as data techniques. Specific experiments have been designed in the classical chemistry areas. For example, the analysis of branched fatty acids of the human skin surface is being considered in Biochemistry. In instrumental analysis the detection of zeranol and zearalenone, used as the fattening agent, in cattle is being used to acquaint the students with some practical approaches to GC/MS. The department also teaches a course in Criminalistics and the use of GC/MS is being used to illustrate the wide applicability of the technique in this area.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Anthony A. Rockwood	USE 8750929
Metropolitan State College	FY87 $6,967
Denver, CO	Atmospheric

"A Spring Thunderstorm Project for Undergraduate Meteorology Students"

The Spring Thunderstorm Project will allow students to measure the vertical profile of temperature, moisture, pressure, and wind in the immediate vicinity of a thunderstorm using a portable weather balloon system. Metropolitan State College will purchase the balloon system, or sounding system, and ground-based data recording equipment with grant funds. Meteorology students will carry the system into the field during the spring thunderstorm season and will release the instrumented balloons into the environments of the storms. The data collected will be used for case studies of the storms and will be the basis for a greater understanding of the storm's structure.

Thunderstorms are one of nature's most important phenomena, yet little is known about their individual formation, detailed structure, or the potentially dangerous weather they may produce. Students involved in this field project will gain valuable experience in observing, instrumentation, and thunderstorm research. The experience they obtain may be applied at a more advanced level of thunderstorm research, where a better understanding of thunderstorms will lead to improved public forecasts and warnings.

COLLEGE SCIENCE INSTRUMENTATION

Bhal C. Barot	USE 8852025
Otero Junior College	FY88 $5,000
La Junta, CO	Chemistry

"Infrared Spectrophotometer for the Organic Chemistry Laboratory"

The infrared spectrophotometer is being used in the one-year Organic Laboratory course and for demonstration purposes in the General Chemistry and Introductory Chemistry courses. The instrument is being used in the Organic Laboratory for regular experiments, such as qualitative analysis for functional groups, and is improving the students learning efficiency as well as the department's instructional capability. Students are also doing special projects such as a kinetic and mechanism study and structural analysis of the products of oxidation reactions of various alcohols using a variety of oxidizing agents.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

John F. Nolte	USE 8750958
Regis College	FY87 $50,000
Denver, CO	Biology

"Laboratory Equipment to Initiate an Integrated Junior-year Course in Investigative Biology"

The project is providing Junior-level Biology majors with basic training in the design, execution and evaluation of scientific research in a two-semester course entitled Investigative Biology. The first semester includes discussions of general principles and the performance of sample experiments from a variety of biological areas using oscilloscopes and other equipment for relatively simple investigations. The second semester consists of the design and performance of a research project from the area of photoreceptor physiology, using some model experiments with the electronic probes, amplifiers, analysis/recording devices and computers to process the data. The students are studying the physiological effects of the timing, intensity and wavelength of light on several types of photoreceptors.

NETWORKS PROGRAM

James Giese	TPE 8470585
Social Science Education Consortium	FY85 $ 92,346
Boulder, CO	FY87 $122,163
	FY88 $114,925
	HS Science

"Building Support Networks for Improved Science/Technology/Society Education"

This is a three-year project designed to focus attention in Science Education at Grades 7-12. The primary goal of this project is to improve the teaching of science/technology/society issues (STS) by promoting collaboration and communication among members of the Council of State Science Supervisors (CS-3), the Council of State Social Studies Specialist (CS-4), and interested 7-12 science and social studies teachers. This collaborative effort will be directed by the Social Science Education Consortium located at the University of Colorado at Boulder and the Mershon Social Science Center located at the Ohio State University.

Project components include (1) developing a curriculum framework and accompanying resource guide that can begin to serve as the basis for sound and coherent curriculum development related to STS issues; (2) building a network of state agency personnel to act as catalysts in helping classroom teachers integrate STS issues into their existing curricula; (3) through the dissemination efforts of CS-3 and CS-4, expanding the network of classroom teachers knowledgeable about STS issues and their effects on science and social studies introduction; and (4) evaluating the dissemination efforts of CS-3 and CS-4 in terms of integrating STS issues into existing science and social studies programs in the secondary school.

The goals and objectives of this project are consistent with the new directions suggested by many of the national reports that call for reform of science education. The project is timely and important since it will increase the capacity of state education personnel to help science and social studies teachers respond to the new challenges to citizenship being posed by the social effects of science and technology in modern America. The project has a sound conceptual base, will build an appropriate and coherent framework and resource guide, will utilize the established networks of CS-3 and CS-4 to disseminate the project's products in order to reach classroom teachers, and has developed an evaluation plan designed to determine the overall effects of its efforts.

INSTRUCTIONAL MATERIALS DEVELOPMENT

James Giese	MDR 8650040
George Koblas	FY86 $156,067
Social Science Education Consortium	FY87 $215,524
Boulder, CO	FY88 $221,749
	Environmental

"Science-Related Social Issues: Computer-Based Decision-Making Exercises"

A three-year project, conducted jointly by the Social Science Education Consortium, Inc., and Omega, Inc., will create a set of eight computer-based decision-making modules focused on public policy issues related to science, technology, and society. Each module will be appropriate for use in grades 7-9 science and social studies courses and will be a self-contained instructional package which can be used by students individually or in small groups.

Issues which tentatively have been identified as subjects for the modules include: Water Diversion and Depletion of Existing Water Sources, Radioactive Waste Management, Can the Projection of Genetic Engineering be Patented?, and Life-Sustaining Medical Technology.

The development of the modules will involve participation of experts from the university and precollege education levels, systems analysts, and instructional designers to ensure that the modules are scientifically sound, bias-free and of professional education quality.

NETWORKS PROGRAM

Irving Morrissett	TPE 8470585
Richard C. Remy	FY85 $ 92,346
Social Science Education Consortium	FY87 $122,163
Boulder, CO	FY88 $ 85,425
	Other NEC

"Building Support Networks for Improved Science/Technology/Society Education"

The primary goal of this project is to improve on science/technology/society issues (STS) by promoting collaboration and communication among members of the Council of State Science Supervisors (CS3), the Council of State Social Studies Specialists (CS4), and interested 7-12 science and social studies teachers. This collaborative effort will be directed by the Social Science Education Consortium located at the University of Colorado at Boulder and the Mershon Social Science Center located at the Ohio State University.

Project components include (1) developing a curriculum framework and accompanying resource guide that can begin to serve as the basis for sound and coherent curriculum development related to STS issues; (2) building a network of state agency personnel acting as catalysts in helping classroom teachers integrate STS issues into their existing curriculum; (3) through the dissemination efforts of CS3 and CS4, expanding the network of classroom teachers knowledgeable about STS issues and their effects on science and social studies instruction; and (4) evaluating the dissemination efforts of CS3 and CS4 in terms integrating STS issues into existing science and social studies programs in the secondary school.

RESEARCH IN TEACHING AND LEARNING

Ronald D. Anderson	MDR 8713052
University of Colorado at Boulder	FY88 $20,565
Boulder, CO	Studies

"U.S.-Western Europe Regional Comparative Study of Elementary School Science Programs"

This award will enable Dr. Ronald D. Anderson, University of Colorado, Boulder, and three other U.S. educational researchers to collaborate with Dr. Uwe Hameyer, Institute for Science Education, University of Kiel, Federal Republic of Germany, and three other researchers from the Netherlands, Sweden, and Switzerland. They will compare the implementation of elementary school science programs in the five home countries of the researchers. The project is being coordinated from the Institute for Science Education in Kiel.

The goal of the research is to study the process of putting quality elementary school science programs into practice and to identify the conditions that foster or restrict their successful implementation. The study will be conducted in a variety of settings where attempts have been made or are being made to implement and institutionalize activity-based elementary school science programs. Each of these countries has developed good curricular materials for science teaching, but has had difficulty in consistently implementing or maintaining activity-based elementary school science programs. An ethnographic approach will be used in case studies in the five countries; this should provide information not usually obtainable from surveys. Dr. Anderson and Dr. Hameyer have successfully collaborated on previous research on science education. The other members of the research group offer important skills and access to the diverse school populations required for the project.

This project is co-funded with the NSF Division of International Programs.

NETWORKS PROGRAM

Manert H. Kennedy	TPE 8550479
University of Colorado	FY86 $70,355
Boulder, CO	FY87 $77,623
	FY88 $77,040
	Precollege Science

"Building a Resource Network to Serve Colorado's Front Range Communities"

The Colorado Alliance for Science is a consortium of schools, school districts, businesses, industries, institutions of higher education, professional societies, research laboratories, state agencies, and community groups working collaboratively to improve precollege science education in Colorado. The Colorado Alliance is seeking to establish a resource-sharing network in science education aimed toward initiation and maintenance of high-quality science programs in schools. The approach used will involve:

- the school principal working with teachers in a school to develop a high-quality science program in accordance with assessed needs of that school.

- sponsors from industry and from higher education working with teams and helping them locate resources and solve problems.

The project will have five phases: organization; recruitment and participant selection; planning and exploration; information-gathering and resource development; leadership. New sets of school teams will proceed through these phases starting at the beginning of each year. The project will be started in four schools; six new schools will start the phases in Year II; 11 new schools will join the network and start the phases in Year III. By the end of three "cycles," each of the 19 schools in the Weld County #6 District will have created a high-quality science program uniquely suited to its needs. Teams that start the project in the first cycle will be asked to help guide new teams that enter during cycle #2. Similarly, cycle #2 teams will assist cycle #3 teams.

COLLEGE SCIENCE INSTRUMENTATION

Thomas P. Huber	USE 8750041
Univ of Colorado at Colorado Springs	FY87 $49,474
Colorado Springs, CO	Geology

"Image Processing/Analysis System and Remote Sensing Center for Undergraduate Students"

The University of Colorado, Colorado Springs, will obtain current production quality image analysis equipment to be used in the undergraduate curriculum for geography and environmental studies majors, geology/geography distributed study majors, and students in other related disciplines. The present curriculum will be redesigned to contain an introduction to image processing at the level of Introduction to Remote Sensing. Traditional air photo interpretation and photogrammetry will still be introduced in this course. The proposed new equipment will be used for the entire Advanced Remote Sensing course. Students will get in-depth instruction and extensive hands-on experience with the new system. The class will be designed so that at the end of the course students on their own will be able to function well with all of the system capabilities to solve real remote sensing and image analysis problems. A new seminar, Practicum in Image Processing, will be added to the curriculum. This course will be the organizational mechanism for establishing the Southern Colorado Remote Sensing Center in which students will elicit real world remote sensing problems from local and regional government agencies (e.g. planning departments), private enterprise firms on a cost paid basis, and university projects. The students will then design, produce, and present their work to the data requester.

INFORMAL SCIENCE EDUCATION

Robert P. Larkin	MDR 8751448
Univ of Colorado at Colorado Springs	FY87 $98,533
Colorado Springs, CO	Libraries

"Let's Talk About Science: A Reading-Discussion Program in America's Libraries"

This project will establish adult lecture-discussion series on scientific topics at libraries throughout the United States, modeled after the "Lets Talk About It" humanities series offered by the American Library Association. Programs and program materials will be extensively tested and evaluated in Colorado libraries before introduction into libraries in five additional states, followed by national distribution.

This program seeks to make effective use of libraries for informal science education. Libraries are highly effective neighborhood resources that are well positioned to offer programs and services, but that have in the past offered few science-related programs. This project's combination of prepared packages of lecture discussion series organization materials and the use of local scientists and engineers as speakers and discussion leaders offers to substantially increase the science offerings of public libraries.

TEACHER ENHANCEMENT PROGRAM

Ruth I. Hoffman	TPE 8751263
University of Denver	FY87 $135,860
Denver, CO	Mathematics

"Incorporating Computers, Calculators and Manipulatives Into Middle School Mathematics Through Teacher In-Service"

The availability of computers, calculators, and manipulatives has raised various questions about the impact of these technologies on the mathematical content and instructional methodology that are related to mathematics curricula at the elementary school level. The purpose of this project is to extend the work of the proposer and her colleagues who have, with previous support from the National Science Foundation, developed a future-oriented mathematics curriculum for grades K-6 along with a teacher inservice outline.

The work in this project is to conduct intensive inservice workshops for about forty teachers at the middle school level who have been designated as master teachers by their school districts. The teachers work within the framework of their present teaching situation, including use of curriculum guides and textbooks, to infuse as appropriate the instructional materials and methods of the project. The workshops will be videotaped and analyzed by the teachers and the project staff. The master teachers will work with the project staff to develop inservice models that are appropriate to their districts. During the year the master teachers will experiment with the instructional methods in their classrooms and prepare to conduct their own workshops for about twenty teachers each in their districts during the year and the following summer, thereby effecting upwards of 800 teachers with this effort.

Products to come from this project are videotapes of the inservice workshops on the use of computers, calculators and manipulatives in the teaching of mathematics at the middle school level; evaluations and reports by master teachers on how to modernize an existing curriculum; and documentation on how the materials that were developed under a previous project were implemented in this experiment.

The proposer has a long and distinguished record in mathematics curriculum development and preservice and inservice teacher education. In addition, she has established a model, highly functional, mathematics laboratory that has served the schools and colleges in her region. She has a reputation for accomplishing excellent results from cost-effective projects.

TEACHER PREPARATION PROGRAM

Henry W. Heikkinen	TPE 8751476
Teresa McDevitt	FY87 $178,057
University of Northern Colorado	FY89 $291,958
Greeley, CO	FY90 $352,526
	FY91 $213,724
	FY92 $106,632
	Elem Sci/Math

"A Model Program in Science and Mathematics for Elementary Pre-Service Teachers"

This project will develop a model approach for the preparation of prospective elementary teachers. The goal of the program will be to have these elementary teachers finish their four years of college possessing integrated knowledge about mathematics and science, innovative teaching skills in mathematics and science, and self-confidence and positive attitudes towards mathematics and science.

To achieve this goal the program proposes to integrate all preservice components -- content courses, methods of teaching courses, education courses, and early, sustained field experiences. The special behaviors and skills (problem solving, modeling, "hands-on" activities) prerequisite for teaching elementary science and mathematics will be stressed. In addition, special instruction strategies (laboratories, discussions, and visual-spatial activities) especially appropriate for groups underrepresented in the scientific/technological fields (women, minorities, handicapped) will be addressed by the comprehensive nature of the project.

It is anticipated that the proposed model will be widely disseminated due to the modular nature of many of the materials, the large numbers of elementary teachers prepared at the university, and the project's close association with new elementary science and mathematics curriculum projects.

TEACHER ENHANCEMENT PROGRAM

Ivo E. Lindauer	TPE 8751260
University of Northern Colorado	FY87 $110,232
Greeley, CO	FY88 $139,160
	FY89 $ 20,413
	Other NEC

"Science, Technology and Society: An Integrated Cognitive Science Teaching Approach"

This project is an opportunity for 72 high school science teachers from Colorado to learn the application of teaching strategies based on findings from cognitive research. After a four-week workshop conducted by three University of Northern Colorado faculty members and a high school teacher, the participants will use these teaching strategies to teach courses which integrate science, technology and societal issues for students who are taking only required courses. The workshop will introduce the science teachers to the principles of cognitive/learning and teaching strategies shown to be effective by cognitive science research and will renew background science content from the life and physical sciences to support the science curriculum that is to be introduced into the classroom.

COLLEGE SCIENCE INSTRUMENTATION

Melvin L. Druelinger	USE 8750177
University of Southern Colorado	FY87 $36,456
Pueblo, CO	Chemistry

"Introduction of Fourier Transform-Infrared Spectroscopy (FT-IR) into the Chemistry Curriculum and Integration with Computer-Controlled Gas Chromatography"

The introduction of Fourier Transform Infrared Spectroscopy, integrated with computer-controlled Gas Chromatography, into the undergraduate chemistry curriculum at the University of Southern Colorado has provided a major tool for introducing students to the use of computer integrated instrumentation, database searching and computer assisted data manipulation. The combination of GC with FTIR allows students hands-on experience with a system dealing with real world complex microanalysis problems as practiced in industry and research. Diffuse reflectance and cylindrical internal reflectance accessories allow students to explore most modern sampling techniques. Courses directly impacted include Organic Chemistry, Physical Chemistry, Instrumental Analysis, Advanced Organic Chemistry and Independent Study. Both majors and non-majors are exposed to this instrumentation.

COLLEGE SCIENCE INSTRUMENTATION

David M. Perkins	USE 8851248
University of Southern Colorado	FY88 $36,536
Pueblo, CO	Electrical Eng

"A VLSI Digital Design Laboratory"

This project permits technology students to study Very Large Scale Integrated (VLSI) circuits using programmable gate array technology. Since programmable gate array devices do not require customized manufacturing, the need for long design cycles and costly integrated circuit fabrication facilities are eliminated. These features make is possible for students to perfect complicated designs in little time at small expense.

The laboratory supporting this project includes the Xilinx development system, simulator and emulator running on a collection of eight PC's.

This award is being matched by an equal sum from the grantee.

CONNECTICUT

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Barbara M. Hilli
Science
Stratford High School
Stratford, CT

Linda N. Raffles
Mathematics
Glastonbury High School
Glastonbury, CT

1988

James J. Landherr
Mathematics
Norwich Reg Voc Tech School
Norwich, CT

Joseph C. Wesney
Science
Greenwich High School
Greenwich, CT

PRIVATE SECTOR PARTNERSHIPS

Lauren W. Kaufman	TPE 8851031
Mary Wilson	FY88 $187,506
Robert A. Rosenbaum	FY89 $262,196
Connecticut Business and Industry Association	Other NEC
Hartford, CT	

"The Hartford Alliance to Improve Mathematics and Science Education"

Under the leadership of the Connecticut Business & Industry Association (CBIA), the Hartford Alliance has been established to strengthen K-12 science, mathematics, and technology education in the Hartford Public Schools. The Alliance is a unique private-public sector partnership seeking to enhance teachers' knowledge and skills in science, mathematics, and computer literacy and provide enrichment for urban minority youth. The Hartford Alliance currently includes CBIA, the Travelers Companies, IBM, Aetna Life and Casualty, the Hartford Public Schools, Wesleyan University, Central Connecticut State University, the University of Hartford, St. Joseph College, the Science Museum of Connecticut, and Choate-Rosemary Hall.

Collaborative programs to improve teaching will be conducted and coordinated through the Alliance. Building on successful statewide models, professional development activities will be provided for at least 180 Hartford teachers. Roughly 35 percent of all 3-6th grade teachers, 50 percent of middle-school science and math teachers, and 25 percent of high-school science and math teachers will be served. Additionally, approximately 750-1000 students will directly participate in enrichment programs collaborating with the Alliance.

By 1989, the Alliance will bring together all private sector math/science partnerships currently operating in Hartford. Because there has been no organizational framework in place for coordinating these efforts, neither the school administration nor the companies involved know the full range of programs offered, who they serve or miss, just how effective they are, or how they interrelate. To address this problem, CBIA and the Hartford Alliance Executive Committee will be responsible for: 1) gathering and disseminating information about all existing math/science partnership programs in Hartford; 2) coordinating these efforts with the Hartford Public Schools; 3) identifying overlapping services, potential areas for collaboration among programs, and unmet needs; 4) encouraging the development of new partnerships to respond to those needs; 5) evaluating the short- and long-term impact and effectiveness of these partnerships; and 6) disseminating information about the Alliance process and its programs locally, statewide, and nationally.

Cost sharing by the partners will total 111% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Lisa M. Baird	USE 8750877
Connecticut College	FY87 $50,000
New London, CT	Biology

"Improving Electron Microscopic Study in the Undergraduate Curriculum"

This project has provided matching funds to purchase a combined transmission and scanning electron microscope (TEM/SEM) to provide enhanced opportunities for students to study and experiment at the cellular level. Central to this development is a course in The Theory and Techniques of Electron Microscopy, designed to familiarize students with the principles of TEM and SEM design and operation. Through intensive laboratory instruction, students gain "hands-on" experience in TEM and SEM techniques and operation which then is applied to selected research projects. The new TEM/SEM enriches laboratory exercises at all levels of the biology program by focusing attention on the cellular aspects of organismal structure, and provides new opportunities for student independent and honors research in Biology.

COLLEGE SCIENCE INSTRUMENTATION

Jack W. Beal — USE 8851344
Fairfield University — FY88 $25,155
Fairfield, CT — Physics

"Gamma Ray Spectroscopy Equipment for Undergraduate Laboratories and Projects"

Fairfield University will purchase a high-volume, high-resolution gamma-ray spectrometry system including a lithium drifted germanium detector, a 16,384 channel analyzer, associated electronics, shielding, and data analysis equipment. This equipment will be used to improve instruction in an advanced nuclear science laboratory, and for individual projects to be carried out by advanced undergraduate students. Many of the projects will involve the analysis of environmental samples using neutron activation analysis.

The grantee will provide funds greater than the NSF award, and will provide a Microvax II computer for use with the system.

Edward J. Poziomek — USE 8850906
Evan R. Ferguson — FY88 $42,547
Sigma Xi Scientific Research Society of North America — Other NEC
New Haven, CT

"Examination of the Nature and Quality of Undergraduate Education in Science, Engineering and Mathematics"

The objective of this project is to provide educational policy makers with a consensus of the views of working scientists, engineers and educators on topics and issues that should be addressed in charting a national effort to improve the nature and quality of undergraduate science, engineering and mathematics education. A principal element of this effort is a report prepared by a National Advisory Group that includes representatives of Sigma Xi chapters and clubs. The grantee is obtaining funds from other sources for this project that are greater than the funds provided by the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Ataollah Elahi — USE 8750749
Southern Connecticut State College — FY87 $31,300
New Haven, CT — Computer Science

"An Undergraduate Computer Hardware Laboratory"

Under this project, a computer hardware development laboratory will be developed. It will include fifteen student stations, each equipped with an Intel SDK-86 microcomputer board, an oscilloscope, digital voltmeter, signal generator and design trainer. The laboratory will support three new lower level courses: Computer Organization and Logic, Microcomputers, and Microprocessor Interfacing.

TEACHER ENHANCEMENT PROGRAM

M.Clare Markham — TPE 8652361
Frank Salamon — FY87 $135,460
Harold T. McKone — Elem Science
Mary E. Murphy
Frank D. Lomanno
St Joseph College
West Hartford, CT

"Improvement of Physical Science Education in Elementary and Middle Schools"

This Leadership Activities project will develop teams of science educators in 20 school districts in central Connecticut which will provide instructional leadership and inservice activities for teachers in the districts' elementary and middle schools. The inservice activities will focus on physical science and address those areas in the science curriculum which are being taught minimally or not at all. The teams in each district will consist of three elementary or middle school teachers, a high school physical science teacher and a science coordinator or curriculum specialist.

The members of the team will prepare for their work in the district in several meetings during the spring of the year followed by a three-week workshop in the summer. College science and science education staff, industrial scientists, and a computer specialist will work with the teams as they prepare curriculum modifications and evolve plans for the inservice activities to be held during the academic year. Both formal and informal follow-up sessions will be held in the schools during the academic year with the college staff continuing to serve as a support for the district teams. A summer internship program in area scientific businesses for selected secondary science teachers on the teams is an auxiliary part of the program. Science Resource Centers will be established in the school districts to assist all teachers in the implementation of the new curriculum units.

The school districts involved have participated in the planning of the proposal and have made a commitment to sustain the program once NSF funding ceases.

COLLEGE SCIENCE INSTRUMENTATION

Harold T. McKone USE 8750142
St Joseph College FY87 $31,585
West Hartford, CT Chemistry

"Incorporation of New NMR Applications in the Undergraduate Chemistry Curriculum"

A 60-MHz Nuclear Magnetic Resonance Spectrometer with variable temperature, spin decoupler, and fluorine observation accessories is being used in courses in organic, physical, biochemistry, instrumentation and student research at St. Joseph College. A variety of new student experiments are being developed. For example: the study of conformational and keto-enol equilibria with the variable temperature accessory; the simplification of complex spectra using the decoupling accessory; and inorganic NMR applications through fluorine-19 observations.

TEACHER ENHANCEMENT PROGRAM

Jane A. Holdsworth TPE 8751267
Thames Science Center FY87 $125,445
New London, CT Ecology

"Project Porifera"

Project Porifera is a cooperative education venture in which museum scientists and educators will train and assist teachers in integrating a newly developed aquatic biology research program into the life science curriculum of twenty junior high schools in the Thames River watershed.

Teachers will be involved in activities designed to upgrade their research skills and content knowledge. Their students will become involved in in-depth investigative experiences, an innovative networking of computer communications, museum displays, and the opportunity for supervised independent student research. Focusing on the freshwater and estuarine ecosystems of eastern Connecticut, Project Porifera is designed to involve regional teachers and students in field studies and scientific surveys on selected bodies of water within the 1,500 sq. mi. Thames River Basin.

A staff composed of a computer specialist, an aquatic biologist and a curriculum specialist will offer twenty teachers courses, field experiences, and classroom training to prepare them to implement this new approach in their classrooms and in the field.

PRIVATE SECTOR PARTNERSHIPS

Jane A. Holdsworth TPE 8851025
Robert Waltz FY88 $150,000
Karen L. Askins HS Science
Thames Science Center
New London, CT

"Project M.E. (Mentors for Explainers)"

Mentor scientists from industry and academia, secondary school science teachers, and museum educators and exhibit designers will collaborate to develop and implement a new student science research and public demonstration program. In a two-year pilot program, 30 teachers and 60 students will be paired with the mentors, predominantly active private sector researchers, to allow each student to develop and carry out a research project. Project topics will be chosen to relate to the museum's unique regional emphasis on the Thames River Basin while simultaneously matching student/teacher interests and mentor expertise.

Each student will be involved for a two-year period. During the first year, she/he will focus on developing and completing the project, which will be monitored by the teacher and guided by the mentor, who will provide technical guidance and facility/equipment support. In the second year the student will work with museum staff preparing materials and explaining/demonstrating her/his project for public and school audiences.

Project M. E. is designed as a demonstration of how a regional science museum can bring together students, teachers, and the private sector to enhance science education for students and promote public understanding of science and technology.

Cost sharing by the partners will total 20% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Dina L. Anselmi USE 8853242
Trinity College FY88 $5,442
Hartford, CT Social Psychology

"Developmental Psychology Lab Improvements"

This Developmental Psychology project studies the perceptual, cognitive and social behavior of infants and children using a variety of techniques. The methods include naturalistic observation, correlation, and experimentation. Behavior is recorded on video tape, observations are coded and entered into a computer for analysis.

The award upgrades the existing Developmental Psychology laboratory with a video camcorder, a remote control video system, a personal computer and printer, and ancillary equipment. Students at the introductory and advanced levels, the majority of whom are women, participate in research studies where they receive hands on experience testing young children. The additional equipment enables students to study a wide range of developmental questions and learn a variety of data collection techniques as well as learning up to date statistical and computer programming skills.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Roy B. Davis, III USE 8750859
Trinity College FY87 $11,602
Hartford, CT Materials Eng

"Automating the Undergraduate Engineering Materials Laboratory"

Under this project, the materials science and engineering strength of materials laboratory will be automated. A bench-top Instron Model 1011, 1000 pound load capacity will be added to the laboratory to supplement an existing 20,000 pound load capacity machine. The new instrument is equipped with an IEEE 488 bus that will be interfaced with a Macintosh Plus computer equipped with a National Instruments interface board and labVIEW software. The students will be able to learn real time control and computer data acquisition and analysis. The experiments planned include the testing of both metals and polymers. In addition, the data acquisition system will be used to measure the electrical properties of materials, including semiconductors.

COLLEGE SCIENCE INSTRUMENTATION

Sharon Herzberger USE 8750763
Trinity College FY87 $6,265
Hartford, CT Behavioral Psych

"Laboratory Equipment to Improve Undergraduate Instruction in Personality Assessment"

Psychologists study human beings to understand the causes of behavior and the circumstances under which specific behaviors may be predicted. For their studies psychologists use a variety of assessment techniques, including interviews, observations, and objective and projective testing. The project will establish a research laboratory to enable introductory-level and advanced students to learn about some of the techniques used by psychologists to understand behavior and assess personality. With the establishment of the laboratory, students will be able to participate in research as subjects and to conduct research themselves. This "hands-on" learning experience is expected to enhance student knowledge of personality assessment and correlational and experimental research methodology, as well as to increase their statistical and computer programming skills.

COLLEGE SCIENCE INSTRUMENTATION

Richard V. Prigodich USE 8750507
Trinity College FY87 $50,000
Hartford, CT Chemistry

"Undergraduate Instruction in FT-NMR"

The use of nuclear magnetic resonance to study molecular structure and dynamics is common in academic and industrial research programs and FT-NMR is the state-of-the-art choice for such studies. A recently acquired 200 MHz FT-NMR spectrometer is being used in a variety of upper level courses for chemistry and biochemistry majors at Trinity College, allowing an existing Varian T-60 to be used in the introductory organic chemistry laboratory.

COLLEGE SCIENCE INSTRUMENTATION

August E. Sapega USE 8851522
Trinity College FY88 $22,010
Hartford, CT Computer Science

"An Undergraduate Computer Graphics Laboratory"

The equipment funded for this project supports a new upper- level Computer Science course in graphics at this institution, a course that serves as the capstone course within a graphics programming concentration. In addition, the laboratory equipment serves as the primary support for a senior-level mathematics course in fractals and chaos.

The laboratory that supports these projects includes Sun color graphics workstations, a printer and plotter and various pieces of graphics software.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Michael E. McKaughan USE 8750498
United States Coast Guard Academy FY87 $11,000
New London, CT Electrical Eng

"An Undergraduate Computer Assisted Scalar Network Analysis Laboratory"

The equipment necessary to assemble a scalar network analysis system for use in an undergraduate antenna design laboratory is being procured. Using a Hewlett Packard 8756A network analyzer as a basis, a system is being constructed to allow students to investigate the transfer characteristics of transmission lines, impedance transformation devices and the design of antennas. Computer programs are being developed to implement the experiments and to perform mathematical computation on the collected data.

COLLEGE SCIENCE INSTRUMENTATION

Porter D. Sherman USE 8750129
University of Bridgeport FY87 $50,000
Bridgeport, CT Computer Science

"An Undergraduate Interdisciplinary Artificial Intelligence Laboratory"

This project is to develop an artificial intelligence laboratory to be shared by both the department of science and engineering and the department of psychology. The laboratory will be equipped with eight "pseudo" Lisp machines which will also have the capability to handle Prolog and Smalltalk. Four new courses are proposed which will be jointly developed by the two departments. Thus, the new lab will serve both the computer engineering and the cognitive psychology students.

COLLEGE SCIENCE INSTRUMENTATION

Gerald T. Volpe USE 8750110
University of Bridgeport FY87 $49,650
Bridgeport, CT Electrical Eng

"An Undergraduate Communication Systems Laboratory"

This project will support five communications courses with an updated communications laboratory. The intent is to give the students hands-on experience with actual equipment so that they can solidify their theoretical knowledge by means of experimental observations. Analog and digital signalling techniques will be covered, including baseband, FSK, PSK, and PCM, matched filtering, and linear and angle analog modulation. In addition, special topics will be covered in the areas of phase lock loops and antenna gain, radiation pattern and impedance matching.

COLLEGE SCIENCE INSTRUMENTATION

Tracy L. Simpson USE 8851605
University of Hartford FY88 $56,564
West Hartford, CT Biology

"Equipment for an Investigation-Centered Undergraduate Cellular Biology Laboratory"

Sophomore and upper-level biology majors, while grounded in the facts of biology, routinely are grossly lacking in an understanding and appreciation of the overall significance of experimental laboratory results. This project addresses this deficiency by establishing a new cell biology laboratory using microscopic techniques exclusively for the elucidation of (1) cell and tissue structure, (2) localization and structure of tubulin and microtubules, and (3) the localization and structure of mitochondria and succinic dehydrogenase. These are being accomplished using histological procedures, bright field microscopy, semithin sectioning, transmission electron microscopy, indirect immunofluorescence microscopy, phase contrast microscopy, and cytochemistry of frozen sections at the light microscope level.

The following major equipment is being purchased in order to establish this laboratory: ultramicrotome, fluorescent microscopes, cryostat and student microscopes. The investigations are being carried out and then used by students as a basis for elucidating the limitations of biological techniques and the incomplete nature of experimental results. Equally significant, this new laboratory provides first-hand, detailed learning of a variety of modern, up-to- date, microscopical techniques. This cell biology course is populated by pre-health professionals, by health professionals who are continuing their education and training, by prospective high school biology teachers, and by a sizeable group of majors.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

R. E. Gaensslen USE 8750754
University of New Haven FY87 $15,086
West Haven, CT Biology

"Biochemical Equipment for an Undergraduate Forensic Science Laboratory in Blood/Body Fluid Identification and Individualization"

Forensic scientists require methods and procedures for identifying and typing the human blood and body fluids encountered in cases of homicide, assault, robbery, sexual assault and other crimes against persons. The Enzyme-Linked Immunosorbent Assay (ELISA) technique offers a desirable alternative to present procedures.

Its major advantages are increased sensitivity, ability to utilize recently developed, highly specific monoclonal antibodies in its tests, and the ability to introduce new levels of quantization and instrumental objectivity in interpreting test results. Modern ELISA instrumentation, its use and applications are revolutionizing forensic tests on blood, body fluids and stains.

In addition, the isoelectric focusing (IEF) technique offers many advantages over earlier electrophoretic procedures for typing blood and body fluid stains. Its advantages include the ability to recognize more genetic types in several systems and thus to improve individualization of stains left by biological materials. The application of IEF to the genetic typing of blood and body fluid stains increases the capabilities of forensic scientists, enabling them to provide more and better evidence to the justice system they serve. Through the help of this grant, future forensic specialists in this model program are being trained on state-of-the-art apparatus. This project constitutes a striking example of science serving society in helping to demonstrate the guilt or innocence of persons accused of violent crimes.

COLLEGE SCIENCE INSTRUMENTATION

M. Ali Montazer	USE 8852376
University of New Haven	FY88 $21,746
West Haven, CT	Ergonomics

"Human Factors/Ergonomics Laboratory Enhancement"

This project permits undergraduate students to study human factors/ergonomics in a state-of-the-art laboratory. Students focus on gathering information on human capabilities and capacities for use in optimal design of jobs, products, equipment and the workplace.

The equipment included in this laboratory includes: gas analyzing equipment used to determine physiological cost of heavy physical work; an environmental chamber which is used to simulate different environmental conditions - for the study of the effect of factors such as heat on work performance; anthropometric instruments used to measure body dimensions in relation to the design and evaluation of the workplace and equipment; and, a microcomputer that is interfaced to the laboratory for data acquisition and analysis.

The equipment is used by students to conduct laboratory experiments as part of their coursework and independent studies and project.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Robert A. Rosenbaum	TPE 8652427
Betsy Y. Carter	FY87 $244,158
Jorge Pezo	Elem Science
Ralph J. Yulo, Jr	
Wilma Toney	
Wesleyan University	
Middletown, CT	

"Statewide Urban Teacher Enhancement Project"

This statewide urban partnership project will provide two intensive residential summer workshops followed by two academic year programs for the mathematical and scientific development of forty elementary and middle school teachers in Connecticut's five largest urban school systems: Hartford, New Haven, Bridgeport, Waterbury and Stanford. The goals are to:

- Enhance the teachers' content knowledge, teaching skills, and leadership talents; and

- Effect long term improvements in minority student access to science and mathematics instruction.

The targeted urban school districts enroll 61% (approximately 60,000) of all minority students attending Connecticut's public schools.

For two successive summers (1987 and 1988) the same forty teachers will attend three-and-a-half-week institutes either in mathematics or science on Wesleyan University's campus. From the perspective of the urban student, the curriculum, teaching techniques, use of manipulatives, and use of calculators/computers will be explored. The science institutes will focus on the basic ideas of earth science, biology, chemistry and physics. The mathematics institutes will focus on concepts of number, measurement, estimation, geometry and computers. During each of the following two academic years, program staff will hold five one-day workshops at Wesleyan, and conduct five special programs in participating school districts.

The Project Director will be Robert Rosenbaum, University Professor of Mathematics at Wesleyan and Director of PIMMS (Project to Increase Mastery of Mathematics and Science). The Project Team will consist of Betsy Carter, mathematics consultant for the State Department of Education; Jorge Pezo, mathematics teacher in Bridgeport; Ralph Yulo of Eastern Connecticut State University; and Wilma Toney, science teacher in Hartford. They represent a diverse cultural and ethnic background. PIMMS, with cooperation of the State Department of Education, will evaluate attitude and performance of targeted students.

This project has the organization and logistical plans in place to establish a long term public and private partnership for strengthened mathematics and science instruction in the urban cities.

APPLICATIONS OF ADVANCED TECHNOLOGY

Elliot M. Soloway	MDR 8751361
Yale University	FY87 $256,941
New Haven, CT	FY88 $ 93,403
	Computer Science

"Computer-Based Diagnosis of Student Programming Errors"

The objective of this research is to explore a few of the key cognitive science, educational, and software engineering issues surrounding the development of effective, computer-based, instructional systems. This exploration will take place in the context of building and evaluating a specific, computer-based, instructional system DEBUG-ASSISTANT. It will provide high-school students with instant, on-line feedback on the non-syntactic bugs in their Pascal programs. In order to build a system capable of coping with (1) a semester's worth of assignments, and (2) the significant variability found in students' programs, a key question in cognitive science will be explored: can bugs and variability be predicted for a domain as complex as programming? In classroom tests of the DEBUG-ASSISTANT the educational utility of providing students with this type of on-line assistance will be examined. Finally, issues of interface design for educational software and software engineering practices as they relate to building modifiable, expert systems will be explored. While preliminary research suggests that bugs and variability can be predicted, and that providing feedback is educationally beneficial, the use of the DEBUG-ASSISTANT will enable an investigation of these issues in a more systematic and rigorous fashion. This effort will be conducted in cooperation with administrators, teachers and students of the New Haven School System.

DELAWARE

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Margaret Christoph
Science
St Mark's High School
Wilmington, DE

Linda B. Selwood
Mathematics
Brandywine High School
Wilmington, DE

1988

Georgia E. Cressman
Mathematics
Gauger Middle School
Newark, DE

Jean Harder
Science
Concord High School
Wilmington, DE

COLLEGE SCIENCE INSTRUMENTATION

Dorene L. Petrosky	USE 8852969
Delaware State College	FY88 $21,360
Dover, DE	Biology

"Biology Laboratory Equipment to Support Undergraduates' Studies of the Health Problems in Black Americans"

Laboratory exercises for various courses are being developed to illustrate underlying biological principles related to major health problems in Black Americans. These activities include electrophoresis of normal and sickle cell hemoglobin, fluorescent antibody demonstration of proteins associated with Graves disease and sickle cell patients, cardiovascular system activities related to hypertension in Black Americans, and biochemical tests to illustrate diabetes, lactose intolerance, and glucose-6-phosphate dehydrogenase (G6PD) deficiency.

Four student stations for electrophoresis experiments, biochemical studies and microscopic work are being set up. In addition, two analytical balances, two pH meters, two variable speed centrifuges, one inverted phase microscope, one fluorescent phase video microscope for class demonstration, and one transfer hood are being installed. Capabilities for the hypertension studies already are available. The project motivates all students, especially minorities, to maintain their efforts in pursuing a biomedically-related career. In addition, the laboratory activities developed will be made available as a laboratory manual for other institutions.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

William R. Hall, Jr.	MDR 8751284
Rae D. Stabosz	FY87 $63,012
University of Delaware	FY88 $ 6,013
Newark, DE	Biology

"Computer Modelling for Biology Instruction"

The marine sciences are of interest to students K through undergraduate school. However computer-aided instruction in the marine science appears to be limited to approximately twenty-four software programs currently available for microcomputers. This project is directed at the 6-12 grade levels in the area of marine biology. The objectives are: to design a lesson to demonstrate the form and function of fishes; to involve students actively in the learning process by providing a computer environment for manipulating fish form, function and habitat in order to "design a fish"; and to demonstrate the concept that evolution is a function of environmental dictates.

The Apple IIc or IIe computer will be used in the development because the Apple II Series is currently the microcomputer used most extensively in the precollege level schools. Evaluation of the lesson will proceed through the Delaware Department of Public Instruction, using Delaware schools. In addition to various inservice programs, the Mid-Atlantic Marine Education Association and the National Sea Grant Program will be evaluating the materials. Marketing will be done through the University office of Instructional Technology.

This project makes excellent use of the appropriate technology in a most suitable fashion. Secondly, the product has high potential to serve as a model for future development in other disciplines. The availability of good software in the area of biology is very low so a real need is being met by highly qualified persons and with a modest budget.

The FY88 supplement will permit the hiring of a professional programmer. Due to the complexity of the proposed programming, the staff has found that it is necessary to hire a professional rather than use graduate students.

DISTRICT of COLUMBIA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

John O. Thayer
Science
Frank W Ballou Senior High School
Washington, DC

Sue P. White
Mathematics
Jefferson Junior High School
Washington, DC

1988

Mariah M. Banks
Mathematics
Calvin Coolidge Senior High School
Washington, DC

Robert A. Morse
Science
St Albans School
Washington, DC

Mark Frankel	BBS 8718904
American Association for the Advancement of Science	FY87 $22,200
Washington, DC	Ethics

"Science, Engineering and Ethics State-of-the-Art Workshop, Boston, MA, February 15-16, 1988"

The office of Scientific Freedom and Responsibility of the American Association for the Advancement of Science (AAAS) will organize and convene a "Science, Engineering and Ethics State-of-the-Art Workshop". The workshop will build on a two-session symposium on this topic to be held on February 15, 1988 at the AAAS Annual Meeting. The symposium and workshop will bring together an interdisciplinary group to assess recent developments in research and education about ethical and value aspects of scientific and engineering practice and its use. The group will produce an agenda of research priorities and mechanisms for implementing research in science, engineering, and ethics. It will also identify priorities and strategies for improving national literacy about freedom and responsibility in science and engineering. The workshop will generate recommendations on these matters for consideration by researchers, educators, public and private organizations and interested individuals.

This project is funded jointly with the Directorate for Biological, Behavioral and Social Sciences and with the Directorate for Geosciences.

STUDIES AND ANALYSES

Shirley M. Malcom	OSPA 8751522
American Association for the Advancement of Science	FY87 $9,720
Washington, DC	Mathematics

"Middle School Mathematics: Meetings of the Minds"

This project supports a meeting held by the American Association for the Advancement of Science (AAAS), Office of Opportunities in Science (OOS), on "Middle School Mathematics: A Meeting of the Minds." This meeting was held on June 11-12 at the AAAS headquarters in Washington, D.C. with the purpose of bringing together mathematicians, mathematics educators, representatives of community-based organizations and experts on early adolescent development to discuss the problems and possibilities of impacting the mathematics learning of middle school students, particularly minority, women, and disabled students. The findings of this meeting will be published as a AAAS occasional report and will be distributed to mathematics-based organizations, researchers, educators, community-based organizations, policy makers, and business leaders.

TEACHER ENHANCEMENT PROGRAM

F.James Rutherford	TPE 8850520
American Association for the Advancement of Science	FY88 $270,111 FY89 $828,284
Washington, DC	FY90 $842,246
	Other NEC

"Phase II of Project 2061: Education for a Changing Future -- Leadership and Curriculum Resource Development"

Project 2061: Education for a Changing Future is a long-term effort by the AAAS to contribute in a significant way to the reform of K-12 education in science, mathematics and technology. Phase I of Project 2061 recommends the fundamental knowledge, skills and habits of mind that all students should possess by the time they leave secondary school.

In this project, which is Phase II of Project 2061, the teacher enhancement component will address the broad content preparation of 125 school educators: 100 teachers and 25 administrators. These participant-teams will be selected from five school districts around the country and will provide leadership for reforming the K-12 curriculum as it bears on science, mathematics and technology. School districts, state educational facilities and universities will participate in this collaborative project.

The goals of the project are (1) to improve teachers' abilities to teach science, (2) to have significant input into the design of curriculum models, and (3) to provide leadership for the reform of K-12 science, mathematics and technology education.

In addition to this grant, an amount equivalent to at least 75% of the requested NSF budget is being contributed by other sources, principally the Carnegie Corporation, which funded all of Phase I of Project 2061.

Virginia W. Stern	MDR 8652147
American Association for the	FY86 $39,663
Advancement of Science	FY87 $ 3,966
Washington, DC	Other NEC

"Resource Directory of Scientists and Engineers with Disabilities"

The AAAS Project on Science, Technology and Disability will prepare, publish, and disseminate a revised and updated Resource Directory of Scientists and Engineers with Disabilities. A new edition is needed as a resource for the entire scientific and engineering community.

The major uses of the print version of the updated Directory will be as a source of:

- role models for disabled youth, their families and teachers; and of specific coping strategies for scientists and engineers disabled in mid-career to learn how to continue in their careers.

- experienced consultants for persons who are inexperienced in teaching or working with a disabled person; and qualified peer reviewers.

- experienced personnel to increase the expertise of individuals and groups which provide technologies for disabled persons.

INFORMAL SCIENCE EDUCATION

Albert H. Teich	MDR 8550294
American Association for the	FY85 $45,042
Advancement of Science	FY86 $70,737
Washington, DC	FY87 $59,660
	Museums

"AAAS Science and Technology Center Project"

The American Association for the Advancement of Sciences (AAAS) is the largest multi-disciplinary scientific organization in the world with a membership of over 140,000 individuals and approximately 300 affiliated organizations. A major emphasis of the AAAS is to increase the flow of knowledge about science and technology within the professional community as well as reaching beyond this primary constituency to the general public. This proposal is aimed at the latter audience.

Over the past three years the AAAS has developed a program using AAAS members as volunteers in their local science museum. Eight museums participated in the pilot project and approximately 1500 AAAS members volunteered their services. The AAAS proposes to expand the project to an additional 10-20 museums.

This project provides an important bridge between the scientist and the general public. AAAS volunteers extend the science expertise and capabilities of the museum and provide models for younger museum visitors. Volunteers have assisted with exhibits, demonstrations, school programs, lectures, workshops, etc. Disciplines include engineers, physicists, physicians, biochemists, computer scientists, geologists and botanists. With supplementary funds, the AAAS will work to involve minorities, women, and the physically disabled in the museum volunteer program.

INFORMAL SCIENCE EDUCATION

Albert H. Teich MDR 8751827
Susan L. Sauer FY88 $142,087
American Association for the Recruitment
Advancement of Science
Washington, DC

"Mass Media Science and Engineering Fellows Minority Recruitment Effort"

The American Association for the Advancement of Science will establish a program of targeted recruitment and placement of outstanding black, Hispanic and Native American students into its Mass Media Science and Engineering Fellows Program. Over a four-year period, a total of fifteen advanced students from the natural and social sciences and engineering will spend ten weeks during the summer working as reporters, researchers, or production assistants with mass media organizations. By the conclusion of the award, corporations and other private sources will be contributing the costs of stipends and recruitment and effective minority recruitment will be an ongoing part of the AAAS Mass Media Program. The AAAS and corporate donors will contribute more than $90,000 in stipends and support over the four-year period.

Allan Watson USE 8850987
American Association of State FY88 $45,532
Colleges & Universities Undergraduate Science
Washington, DC

"The Role of the Comprehensive University in U.S. Undergraduate Science"

The goal of this project is to develop a better understanding of the role of the Comprehensive University in U.S. science, engineering and mathematics education. The Comprehensive Universities are an important segment of the higher education effort and make a significant contribution toward meeting the nation's needs for undergraduate education in science, engineering and mathematics. A central part of the effort is a conference of representatives from the Comprehensive Universities focusing on the topic. A principal resource for the participants in the conference is the pre-conference report which analyzes the problems, describes some approaches for improving undergraduate science, engineering and mathematics education and offering recommendations for further actions by the universities, government and private industry.

TEACHER ENHANCEMENT PROGRAM

Moses Passer TPE 8470375
American Chemical Society (ACS) FY85 $533,996
Washington, DC FY88 $240,172
Chemistry

"Development of an In-Service Workshop Program for Secondary School Chemistry Teachers"

Development of an In-service Workshop Program for Secondary School Chemistry Teachers is a 24-month program that will train 250 well- prepared high school chemistry teachers to provide in-service training to other teachers in the use of the "Doing Chemistry" videodisc materials. The initial development of these materials was supported during the first phase of this grant. Final preparation of the materials will take place during the early part of the continuation period. The remainder of the two-year project will be devoted to the operation of 10 or more one-day workshops at several locations throughout the country. The videodiscs and supporting literature present 125 chemistry experiments and demonstrations aimed at increasing student involvement in "hands-on" chemistry laboratory activities. The American Chemical Society will make these materials available at cost to the educational community.

NETWORKS PROGRAM

Sylvia A. Ware	TPE 8751283
American Chemical Society (ACS)	FY87 $37,486
Washington, DC	Chemistry

"Travel Support for U.S. Participants in the Ninth International Conference on Chemical Education"

Much appears to be happening in science education throughout the world, much of which is quite successful and very worth sharing. This proposal would support the participation of approximately twenty chemical educators in the Ninth International Conference on Chemical Education, to be held in Sao Paulo, Brazil, 26-31 July 1987. Elementary, middle, high school, and college teachers will be represented in the delegation, with the precollege teachers comprising 70% of the total. In order to facilitate the development of international teacher support networks at the conference, and the further dissemination of knowledge gained in Brazil, the teachers selected will agree to undertake a specific information-gathering activity at the conference. Each teacher will select an issue of concern to chemical educators in this country and, through network activities in Sao Paulo, collect the information needed to compare other countries' efforts to address this issue with efforts in the United States. On returning from the conference, they will be expected to write a paper discussing relevant approaches to the issue selected and submit this paper to the American Chemical Society for review. Seven of these papers will be selected for presentation during a special symposium at the ACS Division of Chemical Education's Tenth Biennial Education Conference to be held during July 1988.

This project is funded jointly with the Directorate for Mathematics and Physical Sciences.

NETWORKS PROGRAM

Sylvia A. Ware	TPE 8851139
Isaac D. Eubanks	FY88 $225,650
American Chemical Society (ACS)	FY89 $162,914
Washington, DC	FY90 $162,914
	Chemistry

"ChemCom Dissemination/Networks"

Chemistry in the Community (ChemCom) was designed to provide an attractive, open access route for all high school students to the realm of relevant and useful chemical phenomena. What began as a dream a few years ago is now a well-developed high school program brought about by the concerted efforts of high school teachers, college and university professors, and industrial chemists and financed by the National Science Foundation and the American Chemical Society. This three-year project is designed as a partnership to support the dissemination of the Chemcom curriculum. Specially selected teachers will be educated so that they can become resource teachers who will conduct ChemCom inservice workshops throughout the country. These resource teachers are expected to represent as many as 150 school systems and will reach as many as 2,000 teachers with their inservice programs. The project also includes a series of networking activities entitled "An Evening with ChemCom", the establishment of a computer network, and the production of a newsletter. The evaluation will focus on the effectiveness of this particular model for implementing curriculum change.

The total cost sharing (ACS, Publisher, School Systems) is expected to be almost five times the NSF request.

INFORMAL SCIENCE EDUCATION

Caryl A. Marsh	MDR 8550582
American Psychological Assoc	FY86 $98,980
Washington, DC	FY87 $98,285
	Psychology

"Understanding Ourselves, Understanding Each Other: Psychology's Search--A Traveling Exhibition"

The American Psychological Association, in cooperation with the Association of Science-Technology Centers (ASTC), will develop a series of exhibits on psychology using a discovery room/science laboratory approach. The exhibition will, for the first time, offer museum visitors a first hand opportunity to explore the tools, methods, and concepts of psychology in such areas as thinking and feeling, dreaming and sleeping, perceiving and communicating. The exhibition will travel to eight museums over 30 months through the ASTC traveling exhibition service and will reach over a million visitors.

A wide selection of additional materials and resources such as films, seminars, lectures and workshops will be offered to the participating museums to extend the impact of the exhibition. Plans of the exhibits will be made available to other museums. NSF support represents less than 50% of the total cost of the project.

FACULTY ENHANCEMENT PROGRAM

F. Karl Willenbrock
Louis D. Smullin
Shaoul Ezekiel
American Society for
Engineering Education
Washington, DC

USE 8854218
FY88 $235,617
Engineering

"ASEE Continuing Education for Engineering Faculty"

The American Society for Engineering Education (ASEE) program, Continuing Education for Engineering Faculty, consists of 8 short courses directed at improving the undergraduate engineering faculty's knowledge of new and developing technical subjects. These concentrated courses will be offered in a series of 10-day sessions during the summer of 1988 at host university and industrial sites in the United States, including MIT, Polytechnic University in New York, Georgia Tech, RPI, University of Illinois-Urbana-Champaign, AT&T Bell Laboratories, IBM, Rice University, State University of New York at Binghamton, and the University of Michigan. Courses will be taught by top faculty members or industrial instructors, based on well-developed undergraduate courses. Course offerings will provide engineering faculty with technical and pedagogical information in fields related to their own specialties. Through lectures, hands-on laboratory activity, and interaction with instructors, they will learn to incorporate new material and teaching techniques in revising existing courses and developing new ones. Evaluation of learning achieved and faculty attitudes toward the program will be assessed and used for refining the program. Although current courses are concentrated in Electrical Engineering and Computer Science, future courses will be expanded to include other fields of Engineering.

In addition to the NSF funds, participants will contribute about 60% in travel and subsistence toward the cost of the program. Also, industrial support for 3 of the courses will provide another 60%. Finally, ASEE and MIT will contribute about 15% in staff time.

COURSE AND CURRICULUM

F. Karl Willenbrock
Edmund T. Cranch
Clifford L. Sayre, Jr.
American Society For
Engineering Education
Washington, DC

USE 8854649
FY88 $19,851
Undergraduate Education

"Workshop on a Data Base for Undergraduate Science, Engineering and Mathematics Education"

This workshop considers the collection of descriptive and numerical data on undergraduate programs in science, engineering and mathematics in U.S. universities and colleges. Discussions at the workshop focused on: a) the needs for data about undergraduate programs, b) what types of data are needed, c) how the data may be collected, d) methods for disseminating the data. The participants included individuals from academe, professional societies, public agencies and industry; both prospective data users and those from whom data may be expected to be collected were among the participants.

TEACHER ENHANCEMENT PROGRAM

Gail F. Burrill
American Statistical Association
Washington, DC

TPE 8652421
FY87 $218,837
FY88 $245,759
FY89 $203,732
Mathematics

"Quantitative Literacy: Leadership Training for Master Teachers and Mainstream Educators"

The Quantitative Literacy Project, sponsored by the American Statistical Association, will promote the teaching of statistics in the K-12 mathematics curriculum by providing detailed curriculum frameworks; by training 240 middle school and high school teachers to implement these frameworks using carefully planned strategies which are supported at the local level; and by using materials and methods collected and tested by the participants.

Advice will be obtained from a group of mathematics supervisors, district mathematics coordinators, and experienced teachers of statistics. This group will meet at a Supervisors Conference for three days in order to define the scope and sequence of topics and address the related needs of materials development for teacher training.

With the framework in place a five-day model teaching program will be developed in one contiguous geographic region in which a support network can be developed. This network, supported by the state supervisor, will include 20 master teachers of middle school mathematics, 20 master teachers of high-school mathematics, local statisticians from universities and industries, and mathematics education professors. Each teacher will be selected from a school which will assure that a unit on statistics can be taught in the fall term, and will allow the master teacher to attend six follow-up two-hour discussion groups every two weeks.

Five additional institutes of 40 teachers each will be hosted by resource statisticians in the second year. At the end of the third year, when the follow-up and evaluation are completed, the project should produce: a list of resource persons, including teachers of statistics, statisticians at universities and in industry, and mathematics educators; materials to conduct in-service training in statistics; a manual for basic topics; references for topics not covered by Quantitative Literacy materials; curriculum materials that cover all basic topics; a detailed scope and sequence document for teaching statistics, grade K through 12.

STUDIES AND ANALYSES

Fred C. Leone	OSPA 8513884
American Statistical Association	FY86 $154,300
Washington, DC	FY87 $ 40,000
	FY88 $154,300
	FY89 $154,300
	Studies

"On-Site Research To Improve The Quality of Education Statistics"

The parent grant supports a program of on-site research and visiting fellowships aimed at improving the quality and timeliness of federal education statistical data, along with increasing the adequacy of the principles and guidelines used to collect, analyze, and disseminate these data. As a new and important part of this program, the project will support a series of expert workshops to be held for the purpose of exploring the possibility of utilizing custom designed technology to improve the speed and efficiency of data collection, and information theory to improve the relevance of data collection to education policy goals. The workshops will include educators at state and district levels so that the possibilities for creating a consistent national statistical system are not overlooked. This action is compatible with the National Academy of Sciences' recent report titled "Creating a Center for Education Statistics: A Time for Action," and with an amendment to the House Labor and Education Committee omnibus education bill calling for the creation of a National Cooperative Education Statistical System.

This project is funded jointly with the Directorate for Biological, Behavioral, and Social Sciences.

TEACHER ENHANCEMENT PROGRAM

George A. Seielstad	TPE 8751378
Associated Universities Inc	FY87 $106,262
Washington, DC	FY88 $298,641
	FY89 $273,095
	Astronomy

"Secondary Science Teachers' Institute"

Scientists and technical professionals of the National Radio Astronomy Observatory in Green Bank, West Virginia and science educators from West Virginia University in Morgantown are jointly conducting a Secondary Science Teachers' Institute for 150 selected high school teachers. The summer institute, consisting of 2 three-week sessions will include lectures in basic astronomy and demonstrations to give teachers resources they can use in their classrooms, including an instrumented 40-foot telescope with which participants can make observations of their own. Over the three years of the project the system will be automated to the extent that electronic communication between the classroom and the telescope will permit observations to be made from the classroom. The overall goal of the project is to bring classroom teachers into direct contact with research scientists in order to foster a greater appreciation as to how science is conducted and to provide a glimpse of how knowledge at its boundary with the unknown is acquired.

INFORMAL SCIENCE EDUCATION

Wendy Pollock	MDR 8550270
Association of Science- Technology Centers	FY85 $357,554 FY88 $ 15,000
Washington, DC	Museums

"Traveling Exhibitions in Mathematics, Engineering, and Paleontology: Resource Sharing Among Science Museums"

The Association of Science-Technology Centers (ASTC) is a not-for-profit organization serving 170 science museums nationwide. They propose to reproduce and circulate three high-quality, participatory science exhibits reaching approximately two million adults and children over a two-year period.

These exhibits were developed by three of the most outstanding science museums in the country. The three exhibits are: 1) MILLIONS, about numbers large and small; 2) STRUCTURES, about mechanics and architectural form; and 3) DINOSAURS, about science and imagination in the study of ancient life forms.

ASTC has a ten-year track record of successful development and administration of traveling exhibitions. There is a high demand for participatory exhibits in the 1,500 to 2,00 square-foot range for smaller museums since they do not usually have the staff or resources to develop quality exhibitions in-house.

The project is an unusually effective and efficient use of existing resources at a modest cost and addresses a need to develop and increase cooperative museum activity.

INFORMAL SCIENCE EDUCATION

Wendy Pollock MDR 8751864
Association of Science- FY88 $448,536
Technology Centers Museums
Washington, DC

"Participatory Traveling Exhibitions: Laboratories for Professional Development"

The Association of Science-Technology Centers (ASTC) will develop an unusual "hands-on" training program in exhibit development for science museum staff. This four-year program will strengthen the exhibition capabilities of small and medium-sized science museums throughout the US through a series of workshops and intensive cooperation between ASTC staff, "teaching museums," design consultants, and four "learner museums" that will lead to the creation of four finished exhibitions. Training will be managed by ASTC's existing Traveling Exhibits Service staff, assisted by a Project Advisory Committee and several nationally recognized exhibition consultants.

The project will result in four 1,000 square foot traveling exhibits that will reach more than 2,000,000 visitors at more than 30 museums, four permanent exhibits at the learner museums, and professional training and consultation in exhibit development for more than 30 museums' staff, including long term training of staff from the four learner museums. NSF support will be augmented by $200,000 contributed by the learner museums.

INFORMAL SCIENCE EDUCATION

Bonnie VanDorn MDR 8652310
Wendy Pollock FY87 $32,591
Ellen Horowitz FY88 $31,144
Association of Science- Museums
Technology Centers
Washington, DC

"Institute for New Science Centers"

The Association of Science-Technology Center (ASTC), a non profit organization of science museums and related organizations, has received numerous requests from museum members to develop an in-depth professional development program for top science museum administrators and board members. The largest number of requests is from science centers which are in the planning stages or are newly opened. More than established museums, new and developing science centers face dozens of basic decisions that will affect the character of their museums and their chances for success.

The volume of requests for technical assistance, coupled with the absence of any organized program to meet these needs led ASTC to develop an Institute for New Science Centers. The course is aimed at those who have made a commitment to start a science center or whose doors have opened within the past five years. The grant will cover preparation and evaluation of materials and programs. Participants will pay half the cost of the course.

INFORMAL SCIENCE EDUCATION

Bonnie VanDorn MDR 8550262
Association of Science- FY86 $79,635
Technology Centers FY87 $54,276
Washington, DC Museums

"Survey of Science Museums"

The Association of Science-Technology Centers, representing some 170 science museums, receives regular requests for information on the status of science museums, their education programs, exhibits and other activities. To respond to this need, the organization will collect and analyze data on the status and activities of both member and non-member science museums.

The material will be published as three reports and made available on computer disks for further study. The information is particularly useful to communities considering new museums, and to trustees and contributors to current museums and others who have an interest in the priorities and policies of education and exhibits programs. The project will be assisted by an advisory committee and Dr. Sue Smock, Director of the Center for Urban Studies, Wayne State University.

NETWORKS PROGRAM

Robert K. Yin TPE 8550079
Cosmos Corporation FY85 $299,645
Washington, DC FY86 $149,848
FY87 $ 49,890
Other NEC

"Disseminating Information about Exemplary Science and Mathematics Programs"

This project is aimed at increasing the information available to school administrators, teachers, and others regarding exemplary mathematics and science programs. The project design is based on a dissemination strategy and a case study approach that will provide an effective means to increase the extent, quality, and usefulness of information on existing exemplary programs in mathematics and science.

The investigators are on the staff of COSMOS Corporation, a social science research firm. This corporation has been active in conducting education research, and also has investigated science and technology topics, including the utilization and dissemination of information based on research findings. COSMOS is a minority-owned small business and has several ongoing research projects directly related to the major activities of this project. For example, COSMOS is already studying the role of professional associations in the dissemination and utilization process.

The project has several unique features that incorporate lessons learned from previous research on the dissemination process. These features are: a) the information to be disseminated will cover both a variety of programs as well as in-depth materials on selected cases; b) the format of the specific materials to be disseminated, as well as the communications channels to be used, will be embedded with the activities of four national associations in school administration, mathematics and science. The organizations are: American Association of School Administrators, National Association of Secondary School Principals, National Council of Teachers of Mathematics, and the National Science Teachers Association; c) the use of such professional associations, who will serve as subcontractors in this project, will reinforce existing professional networks; and d) provide intense use of face-to-face interpersonal processes of dissemination.

This project will be used to develop a membership base among administrators and teachers who may later become a special interest group within these associations. This interest group can become the foundation for the institutionalization of this dissemination project beyond the period of NSF funding.

STUDIES AND ANALYSES

Rolf K. Blank OSPA 8751539
Ramsay W. Selden FY87 $261,513
Council of Chief State Sch Officers Studies
Washington, DC

"State-Based Network to Develop Science and Mathematics Indicators"

This is a continuation of an award made to the Council of Chief State School Officers (CCSSO) in FY 1986. In the first year, an inventory was conducted in the states to identify the information they now collect on the dimensions and quality of mathematics and science education, using the framework being developed for such indicators by the National Research Council, and applying a data-collection "shuttle" procedure to describe how each state defines and collects the information.

In the second year, the information compiled through the inventory will be analyzed with reference to emerging models for indicators of math/science education, and strategies and priorities will be set for the development of math/science indicators in each state that will bring states toward a standard model of important, technically-acceptable information.

STUDIES AND ANALYSES

Ramsay W. Selden OSPA 8751549
Council of Chief State Sch Officers FY87 $168,968
Washington, DC FY88 $403,271
Studies

"Consortium to Conduct a State-by-State NAEP Assessment"

The purpose of this proposal is to establish a consortium to carry out, on an interim basis for the 1990 assessment, the kind of consensus planning process that will be necessary for state-by-state administration of the National Assessment of Educational Process (NAEP).

The purpose of this consortium is to establish a steering committee consisting of a representative of each consortium member which will develop and direct a process leading to a series of recommendations to the Center for Education Statistics concerning the conduct of a state-level assessment in 1990. On May 4, 1987, a planning meeting convened by the Council of Chief State School Officers determined on a preliminary basis that it is feasible to conduct a state-by-state assessment on a limited scale in 1990. The group recommended attempting to conduct a consensus planning process to prepare for state-by-state assessment and to identify operational procedures for such an assessment. The group concluded that limiting the assessment to mathematics at the high school (17-year olds) level would be desirable.

The consortium will: 1) Develop and propose a policy statement on the purposes of state-level assessment. 2) Recommend the scope of the 1990 assessment that should be done on a state-by-state basis--confirm the subject (mathematics) and grade levels to be assessed and the extent of participation to be sought. 3) Determine commonalities of opinion and important sources of differences within and among major educational constituencies concerning the subject to be assessed. 4) Recommend the knowledge and skills that should be assessed in the subject. 5) Recommend additional information that should be collected in conjunction with achievement data on a state-by-state basis. 6) Recommend the format that should be used to report state-level assessment and background data.

This project is co-funded with the Department of Education.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Samuel Y. Gibbon
Department of Education
Washington, DC

MDR 8550269
FY85 $469,257
FY86 $474,975
FY87 $467,784
Television

"The Second Voyage of the Mimi"

This project will develop a new set of materials that extend the scope of a previous project, "Voyage of the Mimi", carried out by the Bank Street College of Education. The present project, following the approach of the former one, will develop innovative materials combining television, print, and interactive software to improve the teaching of science, mathematics, and technology, and to convey to children that science is an exciting, rewarding human enterprise. The materials will be developed principally for use in grades four through six, but are applicable through grade eight.

The proposed materials and activities are 12 half-hour television episodes, a teacher's guide and student handbook to accompany the television series, a related classroom learning module that includes interactive software, formative research to guide design of the television programs and the learning modules, and activities to ensure that the materials reach their intended audience and are used appropriately. The television programs will have as their central theme archaeology, chosen because it has high interest appeal for young people, because it combines careful, scientific methodology (measuring, mapping, classifying, decoding), and because it is also formed by many diverse ancillary sciences and supported by an increasing array of technologies. The television format will combine 15-minute dramatic episodes, centering around a voyage of a ship named the Mimi, in a continuing story of scientific adventure followed by 15-minute documentary expeditions that pursue in greater depth scientific or mathematical concepts introduced in the dramatic episodes.

The first "Voyage of the Mimi" project produced high quality materials that were extremely well received by students and teachers in the elementary grades and by the public at large when the television series was publicly aired. The materials proposed for the second project offer promise for substantially improving the teaching of science and mathematics at the elementary level, and for increasing student interest in pursuing the study of science.

This project is funded jointly by the U.S. Department of Education, the National Science Foundation, and several private sources.

STUDIES AND ANALYSES

Andrew Kolstad
Department of Education
Washington, DC

OSPA 8751551
FY87 $ 43,046
FY88 $257,952
Studies

"National Assessment of Science and Math High School Transcript Study"

The NAEP 1987 High School Transcript Study includes two major components: the collection of transcript data and the analysis of transcript data. Under the base period of the contract, a survey organization will conduct in 1987 a high school transcript study of sample members of the National Assessment of Educational Progress (NAEP) 1986 assessment. In the 1986 NAEP assessment, 38,000 high school students who were either 17 years old or enrolled in the eleventh grade (or both) in the 469 sampled schools were included in the assessment. A copy of the high school transcript for each member of this sample will be collected. All the collected transcripts will be transcribed into a standard form, edited, and put on a computer data base for later analysis and reporting.

The reporting of the NAEP 1987 transcript data will be addressed to seven topics: changes in course-taking from 1982 to 1987, student participation in vocational education, handicapped students in vocational education, course-taking patterns and student achievement, student self-reports of course-taking, patterns of exclusion from NAEP assessments, and international comparisons of school curriculum. The first three analysis topics are scheduled for FY 1988 and the last four topics for FY 1989.

STUDIES AND ANALYSES

Jeffrey A. Owings
Department of Education
Washington, DC

OSPA 8651563
FY86 $115,000
FY87 $175,000
FY88 $175,000
Studies

"Teacher Supplement to National Educational Longitudinal Study of 1988 (NELS:88)"

This is for the continuing support of an interagency transfer of funds to the Department of Education to support jointly the National Educational Longitudinal Survey of 1988 (NELS:88) to be conducted by the National Opinion Research Center. NELS:88 is a survey based on the national probability sample of eighth grade students and teachers. These same students will also be surveyed in the 10th and 12th grades and in later years to determine the educational effects in middle and secondary schools on their higher educational and occupational experiences.

This award will support two aspects of the NELS:88 survey, as follows:

1. Teacher Survey - A teacher questionnaire (science and mathematics teachers) will be used in the base-year survey to gather data about the students sampled, the student body as a whole, the teachers themselves (their training, career expectations, courses taught, and textbooks used), and the school's facilities, environment, and policies. Approximately 11,000 teachers will be identified to complete the teacher questionnaire;
2. Math and Science Survey Items -- Two pages of survey items will be added to the eighth grade student questionnaire to ask about student attitudes and aspirations toward math and science. Also, similar items will be asked of the student's parents.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Mary B. Harbeck	MDR 8470545
District of Columbia Public Schools	FY85 $243,783
Washington, DC	FY87 $153,017
	Elem Science

"Model Elementary Science Program"

The District of Columbia Public Schools, in cooperation with the National Science Teachers Association, will operate and evaluate a model elementary school science program for typical students, not those selected for their special aptitude, achievement, or interest in science (as is the case in "magnet" schools). Consistent with time-on-task research, these students will be taught science one hour per day; they will be taught using research-based procedures of inquiry teaching and experiential ("hands-on") learning. Instruction will emphasize involvement of all students in science, and the interrelationships of science and technology with the everyday lives of citizens will be stressed. Through significant private sector involvement, materials and equipment will be provided free to the project through NSTA from publishers and suppliers. In this model, science will become a core activity and teachers at all levels will be assisted in integrating science with other areas of instruction, particularly mathematics and reading/writing development. Additional contributions to the project will come from NSTA, and several teachers and researchers will donate their services to the project. The model program site will provide a setting for workshops for teachers and principals from other D.C. schools that will establish similar programs. Findings of the evaluation study will be widely disseminated to elementary teachers, science educators, and elementary principals as well as to the public.

The project reflects a collaborative effort between the District of Columbia Public Schools and the National Science Teachers Association, and involves the support of several private sector companies and various parent and community groups.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Paul J. Cunningham	MDR 8550905
Gallaudet University	FY86 $117,238
Washington, DC	FY87 $115,000
	FY88 $ 80,008
	Life Sciences

"Microcomputer Technologies in the Facilitation of the Hearing Impaired in the Life Sciences"

The purpose of this project is to produce microcomputer programs suitable for use by hearing impaired students. Several hundred bioscience instructional programs, developed for populations of non-handicapped students, will be identified. The project staff will then select and modify about 30 of these which meet specific criteria required for use by the target audience. Modifications will include changes in the content of the software and the use of more basic and concrete instruction, a simplified vocabulary, grammatical structures more understandable to the deaf students, and increased numbers of visuals.

The project will field test the software with deaf students who are on the campus of Gallaudet College in Washington, DC. These students will be 9th through 12th graders at the Model Secondary School for the Deaf, and freshmen and sophomores in undergraduate programs of the College.

The goal of the project is to improve the availability of microcomputer programs in secondary and post-secondary institutions for teaching deaf students across the United States. These include some 900 high schools/programs/classes for deaf students, and 75 post-secondary programs serving the deaf.

COLLEGE SCIENCE INSTRUMENTATION

Paul J. Cunningham	USE 8750493
Gallaudet University	FY87 $24,571
Washington, DC	Biology

"Equipment for Teaching Field, Survey, and Analysis Techniques in Environmental Biology to Undergraduates"

A new course "Field, Survey, and Analysis Techniques in Environmental Biology" is being developed. This new course is introducing the students to new concepts and techniques in ways designed to stimulate interest in investigative studies and in research projects. Using the equipment procured through this award, Biology majors are gaining experience in the description and analysis of ecological systems, as well as in hypothesis structuring, field sampling, literature retrieval and use, descriptive and analytical statistical techniques, field surveys and experimental design methods.

Methods and techniques involved in field studies of aquatic and terrestrial habitats are being introduced through studies of aquatic and terrestrial components of the Anacostia and Potomac Rivers and the Chesapeake Bay. Students are becoming better prepared for future graduate or lab/research positions by using the newly available fluorescent and phase microscopes, fluorometer, ion analyzer, spectrophotometer, sieve shaker, incubator, colony counter, furnace, and BOD and pH meters. Like all other parts of the Gallaudet curriculum, this program is designed especially to meet the needs of students with severely impaired hearing.

TEACHER ENHANCEMENT PROGRAM

Harvey Goodstein	TPE 8554408
Gallaudet University	FY86 $327,888
Washington, DC 20002	FY88 $225,115
	FY89 $ 21,756
	Math/Computer

"Summer Institute in Mathematics and Computer Science for Precollege Teachers of the Hearing Impaired"

The Department of Mathematics and Computer Science of Gallaudet University will sponsor the 1986-1988 Summer Institute in Mathematics and Computer Science for Elementary and Secondary Teachers of Hearing Impaired Persons. One hundred and ten elementary and secondary teachers of the hearing impaired from various schools across the country will come to Gallaudet for a six-week workshop in each of three years. Fifteen elementary school teachers and fifteen secondary teachers who will be selected to participate in year one will have the opportunity to choose courses in mathematics, computer literacy, geometry and advanced algebra. Nine credits will be awarded for the completion of these courses, which will include training in the basic concepts of mathematics, computer programming and applications, and methodology and application of classroom teaching skills.

The project director will be visiting the schools during the school year to observe and follow-up the progress of the teachers in their classrooms. He will offer the resources of the University as well as the project staff to help the teachers improve their mathematics teaching.

YOUNG SCHOLARS

Richard W. Meisegeier	RCD 8850218
H.David Snyder	FY88 $128,210
Gallaudet University	Physics
Washington, DC	

"Gallaudet Summer Science Program"

The Gallaudet University Honors Program sponsors a four-week summer residential program for 15 pre-college, hearing-impaired students. The disciplinary focus of the program is physics and engineering. Projects, organized as competitions, range from solar collector design and construction to evaluation of building energy load; from trajectory prediction to construction of a standing framework.

The Gallaudet Summer Science Program serves as a prototype for presenting science as a career to students in this small sub-population of disadvantaged and disabled youth. This pilot program will make itself available to other geographic locations in the future, hence will be accessible to a larger number of students. (Gallaudet University has established regional centers at Flagler College, Florida; Eastfield College, Texas; Johnson County Community College, Kansas; Ohloney College, California, and Northern Essex Community College, Massachusetts).

COLLEGE SCIENCE INSTRUMENTATION

H. David Snyder	USE 8750356
Gallaudet University	FY87 $36,869
Washington, DC	Electrical Eng

"Undergraduate Engineering Technology Program for the Hearing Impaired"

The Physics Department of Gallaudet University will establish programs in Computer Engineering technology and exit at three levels of proficiency: A.A. (Engineering Technician), B.S. (Engineering Technologist) and Certificate (suitable for change of career re-training). Instruction will be laboratory oriented emphasizing hands-on-experiments for all topics. All faculty serving the program will be proficient in the Simultaneous Method of Communication for hearing impaired persons. This method of communication employs the simultaneous use of sign language, finger-spelling and speech permitting each student to employ the method in which he or she is most proficient. Thus, this program in addition to being a model for the training of the hearing impaired will also serve as a model for programs in which it is desired to give hearing and hearing impaired students full and equal access to classroom instruction and faculty assistance.

COLLEGE SCIENCE INSTRUMENTATION

Robert L. Williams	USE 8750332
Gallaudet University	FY87 $15,441
Washington, DC	Experimental Psych

"An Undergraduate Laboratory Course in Experimental Psychology"

The scope and quality of undergraduate research in experimental psychology is being expanded and upgraded. The new equipment is allowing laboratory experimentation in four areas: psychomotor performance; biofeedback; operant conditioning; and perception and cognition. As a liberal arts university for deaf students one focus of laboratory experimentation and research in the undergraduate experimental psychology course is on the sensory, motor, cognitive and physiological concomitants of deafness. Under the plan students are learning the basic principles of experimental design, data analysis, and preparation of reports by conducting experiments which are both interesting and instructive, utilizing modern and advanced instrumentation. Psychomotor equipment, biofeedback equipment, and operant conditioning equipment have been added as well as a constant illumination projection tachistoscope. In addition to strengthening the undergraduate course in experimental psychology, the equipment is contributing to improvements in other experimentally-oriented courses,such as perception, learning, motivation and independent study (supervised student research).

TEACHER ENHANCEMENT PROGRAM

Jack G. Chirikjian	TPE 8550988
Georgetown University	FY86 $ 82,666
School of Medicine	FY87 $128,710
Washington, DC	FY88 $143,684
	Biology

"Biotechnology Workshop for Teachers"

The "Biotechnology Workshop for Teachers" will provide sixty biology, chemistry and general science pre-college teachers theory and application of the basic principles of biotechnology as developed in the past ten years. Specifically this project will build the confidence of the participant teachers on the subject of biotechnology by up-dating their knowledge through "hands-on" laboratory participation and providing experiences in developing laboratory/lecture materials and utilizing specially prepared molecular biology kits that will be made available to their high school students. The six-week summer workshop will be held at Georgetown University and will include opportunities for independent research and informal discussions on data analysis and experimental design.

The long-term goal of this project is first to initiate the training of sixty high school teachers within a fifty mile radius of Washington, DC Metropolitan area and later to expand this program over a wider area for a broader impact. A second major goal is to develop, in conjunction with private industry, the necessary reagents critical to study the major areas of biotechnology.

This is an exciting and challenging opportunity for teachers to engage in a focused program starting with key experiments in molecular biology. Teachers who show promise to be catalytic focal points in their respective school systems and ability to incorporate the materials in the classrooms and school districts will be selected for this workshop. Follow-up and evaluation procedures by the project director will continue to provide help for the teachers within their classrooms and in their roles as resource persons.

This project is on the cutting edge of science and education. It embodies the important aspects of the Leadership Workshop program by helping teachers to improve their own teaching and to make a positive impact upon their colleagues and school curriculum. The laboratory is stressed and teachers are encouraged to do independent research and to become involved in the various projects that are currently of interest to the project director. It is anticipated that some participants will continue collaborating on research projects during the school year.

A supplement in FY88 will enable Georgetown University to disseminate information about their project to national audiences at two professional meetings.

The project will enable teachers to obtain training in the area of Biotechnology theory into their classrooms.

The Principal Investigator will represent two separate workshops, one day each, to teachers attending both the National Science Teachers Association meeting and the National Association of Biology Teachers meetings.

EDVOTEK, Incorporated will share in the expenses associated with the workshops.

TEACHER ENHANCEMENT PROGRAM

Jack G. Chirikjian	TPE 8751449
Georgetown University	FY88 $529,587
Washington, DC	FY90 $236,847
	Biology

"Biotechnology Workshop for Teachers: Additional Programs"

This proposal is a collaborative effort of four colleges (Georgetown University, Canisius College, University of San Francisco, and Seattle University) to incorporate biotechnological concepts and laboratory experiments into high school science curricula, particularly biology and chemistry. The project is an outgrowth of a successful teacher enhancement project at Georgetown University under the leadership of Dr. Chirikjian in the area of biotechnology. Teachers and college scientists at the three other institutions participated in the 1987 summer program at Georgetown in preparation to serve as lead teachers and project directors in their areas.

During the Georgetown project, a laboratory kit and reagents were developed to facilitate conducting the key experiments in high school science classrooms. In addition, during this project, a set of key technique videotapes will be developed to assist teachers in implementation efforts. Participating teachers have assisted in the design refinements of the kits and reagents to assure their most effective use in high school classrooms.

Georgetown University staff will provide staff and materials support to the satellite colleges in the initial years of the project. School district and local private sector support will augment NSF funding in the implementation of the project. The project will be fully implemented in each of the satellite colleges during the period of this project and plans will be developed for the continuation of appropriate project related activities after NSF funding ceases.

NETWORKS PROGRAM

John G. Harvey	TPE 8850590
Mathematical Association of America	FY88 $39,514
Washington, DC	Mathematics

"Mathematical Association of America Prognostic Testing Network Project"

This twelve-month project of the Mathematical Association of America (MAA) will establish a Prognostic Testing Network. The testing will use college-level placement tests to predict deficiencies in high school juniors. With the knowledge of these deficiencies, high school students that plan to go on to college can, during their senior year, remediate their deficiencies so that upon entering college they are more likely to be placed in college level courses. Prognostic testing programs have been either started or established in eight states and at least six states are known to be interested in prognostic testing. The MAA Prognostic Testing Network will organize these efforts and provide a network by which information can be exchanged and additional states could obtain help in starting their own programs. The project will sponsor a two-day conference to discuss and disseminate the prognostic testing model and to organize the MAA Prognostic Testing Network.

The cost sharing for this project will be thirty-eight percent.

NETWORKS PROGRAM

R. O. Wells, Jr.	TPE 8751416
Mathematical Association of America	FY87 $265,688
Washington, DC	FY88 $ 46,582
	Mathematics

"The American Mathematics Project: Teachers Helping Teachers"

The American Mathematics Project is a three-year program designed to enhance mathematics teacher competence by increasing substantially the number of local Mathematics Teacher Projects (MTP's) in the United States. An MTP is a local cooperative effort by teachers, college and university faculty, and professionals in industry to stimulate excellence in teaching at all levels, but especially in grades K-12.

The project will first organize and conduct a national MTP Workshop to bring together teams from 20 local areas interested in establishing MTP's in their communities and 25 resource leaders from existing successful MTP's. The Workshop will allow for extensive discussions between mentors and the participant teams and help the teams formulate specific action plans for local implementation.

During the two-year period following the Workshop, the AMP staff will maintain close ties to the 20 teams and provide assistance to them in several ways until active MTP's have been launched. This assistance will include a quarterly MTP Newsletter containing useful news and information for the developing MTP's, and consultant visits to the sites of developing MTP's. In addition, an MTP Resource Manual will be published, using the experience of the Workshop and follow-up activities, containing a comprehensive kit of information and guidance for emerging MTP's.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Alfred B. Wilcox	MDR 8470469
John M. Jobe	FY85 $203,775
Mathematical Association of America	FY86 $327,702
Washington, DC	FY87 $210,919
	FY88 $104,210
	Mathematics

"Applications in Mathematics - An Instructional Program for High Schools"

The purpose of this project is to assist the mathematical community in introducing into the secondary school curriculum a viable component in problem solving and applied mathematics. Materials will be produced and disseminated nationally by the Mathematical Association of America (MAA). Six learning modules will be developed which will permit secondary school teachers to involve their students in an experiential, case-study approach to problem solving in mathematics. They will be field tested and evaluated at eight sites throughout the United States.

A Learning Module is a self-contained instructional package of written, video, and microcomputer materials for the secondary school student and teacher which involves the student in problem solving as it occurs in industry. Each learning module is based on a problem posed and presented by a person employed by a particular company, firm, or government agency. The Learning Modules provide the teacher with a total instruction package that replicates in the classroom the spirit of research and problem solving in a "real world environment." The teacher will have the option of using the material with an entire class, a group of students or a single student for independent study.

The project is attempting to show students serious applications of mathematics which should be more motivating than the artificial problems frequently found in current texts. Studies have shown that the ability to creatively solve problems is a skill acquired by few of the students graduating from our precollege institutions. It is significant that this important component of mathematics instruction be the focus for the development of materials by a major mathematical association which will help to ensure widespread dissemination and usage.

Gesina C. Carter 8820144
National Academy of Sciences FY88 $14,420
Washington, DC Other NEC

"Committee on Data for Science and Technology (support of U.S. National Committee dues to membership in ICSU)"

This award will permit the National Academy of Sciences (NAS) to manage U.S. dues for the membership of the Committee on Data for Science and Technology (CODATA) in the International Council of Scientific Unions (ICSU) for the 12-month period beginning January 1, 1988. The National Science Foundation (NSF) also provides funding to the NAS for the U.S. Advisory Committee for ICSU and the U.S. National Committees for 20 constituent unions. The Division of International Programs coordinates NSF's activities in fostering international scientific cooperation, including providing broad access by U.S. scientists and engineers to the benefits of selected nongovernmental international organizations. ICSU, with its worldwide representation of scientific fields, is among the more important of these for U.S. scientists and engineers. CODATA is an interdisciplinary scientific committee of ICSU that seeks to improve the quality, reliability, management, and accessibility of data of importance to all fields of science and technology. Because all major industrialized nations are members of CODATA, and all major scientific unions are represented, CODATA provides a unique forum for U.S. scientists and engineers to advance their international interests in a wide range of disciplines and to help solve associated data problems.

This project is co-funded by several elements of the Foundation.

Mary Martha Treichel 8803590
National Academy of Sciences FY87 $1,177,712
Washington, DC FY88 $1,367,856
Other NEC

"International Council of Scientific Unions (ICSU) Program "

This continuing award will permit the National Academy of Sciences to continue to manage U.S. national membership and participation in the International Council of Scientific Unions (ICSU) and its constituent bodies for the 12-month period beginning April 1, 1988. Funding will be provided to NAS for paying annual dues and furnishing substantive and administrative support for the U.S. Advisory Committee for ICSU and the U.S. National Committees for 20 constituent unions. The Division of International Programs coordinates NSF's activities in fostering international scientific cooperation, including providing broad access by U.S. scientists and engineers to the benefits of selected nongovernmental international organizations. ICSU, with its worldwide representation of scientific fields, is among the more important of these for U.S. scientists and engineers. NAS has continued to demonstrate its capabilities and competence in its stewardship of the ICSU Program. ICSU provides a unique forum for U.S. scientists and engineers to advance their discipline-related international interests. During the first years of this award, there was a renewed interest in future global institutions for multilateral scientific and engineering cooperation. During this period, NAS assured active U.S. participation in ICSU's programs and satisfactory management of dues payments. In consideration of the continued merit of ICSU as a way of providing opportunities for cooperation in a multinational and multidisciplinary context, and of the highly satisfactory management of U.S. participation through the National Academy of Sciences, the program manager recommends an award.

This project is co-funded by numerous elements of the Foundation.

APPLICATIONS OF ADVANCED TECHNOLOGIES

Burton H. Colvin MDR 8851098
National Bureau of Standards FY88 $28,000
Washington, DC Computer Science

"Invitational Seminar for Computer Science, Mathematics, and Science Faculty of Minority Institutions"

This project is a National Science Foundation and National Bureau of Standards outreach program for faculty of minority institutions.

The proposed conference presents an opportunity for NSF to acquaint 40-50 faculty members from minority institutions with relevant NSF programs and NSF in general. It also provides an opportunity for NSF program officers to identify key people at minority institutions who can facilitate the identification of potential reviewers and who can identify researchers and encourage participation in NSF programs.

The strengths of the proposal are that (1) prior conferences have been judged useful to the National Bureau of Standards, (2) joint sponsorship will significantly reduce the costs for all sponsoring agencies and programs, (3) this form of activity moves beyond passive approaches of individual programs and acts as a catalyst for the whole Foundation.

This project is co-funded with the NSF Directorate for Computer and Information Science and Engineering.

INFORMAL SCIENCE EDUCATION

Neal Conan	MDR 8751447
National Public Radio	FY87 $574,449
Washington, DC	FY89 $240,698
	FY90 $210,939
	FY91 $180,623
	Broadcasting

"Science Coverage on National Public Radio"

With support from the National Science Foundation (NSF), National Public Radio (NPR) will provide five years of operation of NPR's Science Unit to provide science and technology news and information on NPR's MORNING EDITION, ALL THINGS CONSIDERED, and WEEKEND EDITION shows.

Prior NSF support has allowed NPR to create stable, sustained, in-depth science coverage on the national network of 335 local public radio stations. More than 9,000,000 people a month, or 2.5% of the U.S. population each week, listen to NPR's news magazines. Science coverage includes 400-500 science stories each year.

NPR's News and Information Service is widely acclaimed; awards have included the Alfred I. DuPont Columbia University Journalism Award, and the Science Unit's staff's Westinghouse-AAAS Science Journalism Award and the National Association of Science Writers' Science in Society Award.

With this five-year award, NPR will consolidate the gains that have been made, continuing to provide the coverage that has earned their reputation, while moving towards financial independence from NSF.

INFORMAL SCIENCE EDUCATION

Robert Siegel	MDR 8841800
National Public Radio	FY88 $15,000
Washington, DC	Broadcasting

"Science Coverage on Public Radio"

This supplement to National Public Radio's Science Reporting Unit will allow NPR news coverage of the A.A.A.S. Award meeting in Boston February 11-15, 1988.

STUDIES AND ANALYSES

Edwin D. Goldfield	OSPA 8550971
National Research Council	FY85 $130,000
Washington, DC	FY86 $136,454
	FY87 $ 70,000
	FY88 $104,360
	Studies

"Study on Statistics on the Supply and Demand for Precollege Science and Mathematics Teachers"

This is a supplemental award to a contract to the National Academy of Sciences/National Research Council to study the supply, demand, and qualifications of precollege science and mathematics teachers. Purposes of the main study are to:

(1) Conduct case studies of teacher flows in selected schools or school districts to supplement the review conducted in the first phase of state and national models of teacher supply and demand. The purpose of the case studies is to identify additional variables that need to be included in supply and demand models in order to realistically model labor markets for teachers.

(2) Conduct a comprehensive review and evaluation of state data pertinent to teacher supply and demand. State data bases represent a major resource for analyzing characteristics and behavior of key components of the teacher labor market, including attrition among current teachers and reentrance of persons with previous teaching experience. The panel will review information on available state data resources obtained by panel staff and consultants and through projects of the Council of Chief State School Officers and the Rand Corporation.

STUDIES AND ANALYSES

David A. Goslin — OSPA 8751547
National Research Council — FY88 $150,000
Washington, DC — FY89 $ 75,000
Studies

"U.S. Board on International Comparative Studies in Education"

Recent experiences with funding and managing U.S. activities in international assessments of science and mathematics achievement have demonstrated a number of problems such as high rates of non-response and uneven survey methodology. As a result, the National Academy of Sciences has proposed the establishment of a U.S. Board on International Comparative Studies in Education. The general purpose of this board would be to oversee U.S. involvement in international comparisons of education, particularly in student achievement. More specific purposes would be to (1) provide a forum for information and discussion; (2) endorse U.S. participation in international studies; (3) assist in planning the conduct and funding of studies; (4) establish standards regarding quality of study design, data collection and analysis procedures, and report preparation; and (5) assist in the dissemination of study findings. The studies of special concern for the near future are those conducted under the aegis of the International Association for the Evaluation of Educational Achievement (IEA).

This project is co-funded with the Department of Education.

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GRADUATE FELLOWSHIP PROGRAM

Susan W. Sherman — RCD 8751542
National Research Council — FY86 $1,270,210
Washington, DC — FY87 $1,446,350
FY88 $1,487,177
Services

"Providing Evaluative Services for the NSF Graduate Fellowship Program, NSF Minority Graduate Fellowship Program and Accompanying Ancillary Services"

Under a cooperative agreement, contractor provides printing and dissemination of NSF-approved announcements and application materials; receipt and collection of application materials; arrangement and hosting of review panels; computer listings of applicant evaluation information; and ancillary services.

Philip M. Smith — TPE 8550917
National Research Council — FY86 $330,000
Washington, DC — FY87 $250,000
Mathematics

"Establishment of a Board on Mathematical Sciences Education"

The National Research Council, the principal operating agent of the National Academy of Sciences and the National Academy of Engineering, has established a 36-member Board of Mathematical Sciences Education (MSEB). Its primary purpose is to provide a continuing national assessment capability for mathematical sciences education at all levels. The Board will provide leadership, service, and coordination through a variety of work products focussed on issues affecting the quality of instruction in the mathematical sciences.

The conception of the MSEB has evolved through a broad base of input from the mathematics and mathematics education communities. Emanating from two national conferences on precollege mathematics education, the Conference Board of Mathematical Sciences endorsed the recommendation of its specially convened task force which urged the establishment of such a board at the National Research Council.

The MSEB will function with an anticipated outreach extending to the state and local levels throughout the nation. Its activities will be conducted through issue-oriented task forces that will report to the Board. The membership is broadly representative to bring perspectives of classroom teachers, local and state school authorities, educational administrators and supervisors, local, state and federal governmental officials, college and university faculties, leaders of professional mathematics and education associations, parents, and employers. An Executive Committee of the Board, chaired by Dr. Shirley A. Hill, will help to guide the overall efforts. Appointments, reports, and other activities of the Board will follow the procedures of the National Research Council.

The purpose of this National Science Foundation grant is to provide initial support for activities in two targeted problem areas, "Framework and Alternative Models for School Mathematics Curricula" and "Study of the Impact of Testing on Mathematics Education K-14." Special committees and panels will be operationalized to prepare concept papers and to design study procedures, to conduct open forums and surveys, and to return specified deliverables. It is expected that each of these problem areas will receive continued attention during the second year of anticipated support. In addition it is expected that a third domain of activity, "In-service Teacher Development", will receive attention and support.

INSTRUCTIONAL MATERIALS DEVELOPMENT

William Spindel MDR 8751873
National Research Council FY87 $25,000
Washington, DC Chemistry

"Opportunities in Chemistry: Today and Tomorrow"

This proposal concerns support for printing of a National Academy of Science book about chemistry, and distribution for teachers and students in conjunction with "Chemistry Day". The schedule of this event is very short, and a principal virtue of the activity is its role in encouraging participation of practicing research chemists in the problems of science education.

Responding to suggestions from the scientific community, the NAS is seeking to expand dissemination of the report, OPPORTUNITIES IN CHEMISTRY, to the high school level. A special edition of the report, suitable for high school chemistry teachers and advanced placement students is being prepared to be available nationally. The bulk of the costs - fees to the authors, printing, and distribution - are being borne by the NAS and by non-federal organizations dedicated to the welfare of chemistry, including the American Chemical Society, and the Council for Chemical Research.

NSF is providing $25,000 as partial support for supplemental printing and distribution of the report, in an overall budget of $95,000.

Marcia P. Sward USE 8751418
Frank L. Gilfeather FY87 $149,985
National Research Council Mathematics
Washington, DC

"The Mathematical Sciences in the Year 2000: Assessment for Renewal in U.S. Colleges and Universities"

The mathematical sciences in U.S. colleges and universities must respond to dramatic changes in the nature of mathematics in the past 15 years and prepare for the rapidly changing and complex national needs of the future. The project MS2000 will produce a comprehensive assessment of college and university mathematical sciences and an agenda for reinvigoration immediately and for renewal by the year 2000. The present undertaking involves planning, initial staffing, the preparation of a review paper on the supply and utilization of mathematical talent, and the formation and one meeting of an oversight committee.

This project is funded jointly with the Directorate for Mathematics and Physical Sciences.

NETWORKS PROGRAM

Marcia P. Sward TPE 8751886
National Research Council FY88 $90,000
Washington, DC Mathematics

"Study of Acceptance of National Council of Teachers Standards for School Mathematics"

The Mathematical Sciences Education Board (MSEB) of the National Research Council is engaged in a multi-year joint project with the National Council of Teachers of Mathematics (NCTM) to provide states and local school districts with a clear statement of what constitutes excellence in school mathematics. Such standards could be used for evaluating current programs and determining how they can be improved. This project would engage many different networks in analyzing both the NCTM standards and the new MSEB framework that is being developed to set future direction for mathematics education. Representatives from school boards, state agencies, school administrators, and parent groups will be asked to react to the proposed recommendations. This activity will provide feedback to NCTM on the appropriateness and intelligibility of the standards as drafted and allow the mathematics education community to focus on possible impediments to acceptance of higher standards and more dramatic change.

Marcia P. Sward USE 8851133
National Research Council FY88 $275,600
Washington, DC FY89 $300,600
Mathematics

"Mathematical Sciences in the Year 2000: Assessment for Renewal in U.S. Colleges and Universities"

Extending the work begun under a previous NSF grant, this two-year award will support a comprehensive study of the mathematical sciences at the undergraduate level. Entitled "Mathematical Sciences in the Year 2000," this study will assess the needs, resources, and opportunities in undergraduate mathematics education. It will also promote dialogue within the mathematical community about these issues and develop recommendations for the "renewal" of collegiate mathematics. Products of the project will include three review papers describing talent, curriculum, and resources. In addition, the award will support the inclusion of undergraduate mathematics in the Mathematical Sciences Education Board's forthcoming "Reports to the Nation."

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

STUDIES AND ANALYSES

Marcia P. Sward	SEE 8751550
National Research Council	FY87 $260,000
Washington, DC	FY88 $260,000
	Mathematics

"Support for the Mathematical Sciences Education Board"

This grant provides support of core projects of the Mathematical Sciences Education Board (MSEB) of the National Academy of Sciences. MSEB was established in October, 1985, with the mandate of effecting comprehensive and far-reaching changes in mathematics education at all levels within the United States. The complex undertaking of systematically analyzing and addressing the nation's needs was launched with the assistance of a $300,000 grant from Science and Engineering Education, most of which was applied to a curriculum study. Support for the following core activities is provided: analysis of the mathematics education system across the nation; identification of critical intellectual and policy issues and planning and stimulation of coordinated work on these issues; synthesis of the best ideas available; and communication of these results to state, local and federal education and science agencies, to parent groups, and to the general public. The products of this multi-year enterprise will be periodic reports and position papers, meetings and conferences, and several Reports to the Nation.

This project is co-funded by numerous elements of the Foundation.

TEACHER ENHANCEMENT PROGRAM

Bill G. Aldridge	TPE 8751313
Edward D. Lozansky	FY87 $153,025
National Science Teachers Assoc	FY88 $202,617
Washington, DC	Physics

"Mathematics, Physics, and Computer Science Summer Institute for High School Teachers "

The National Science Teachers Association in cooperation with the University of California at Los Angeles will conduct a Physics and Computer Science Summer Institute for High School Teachers for 48 physics teachers of gifted students. Participants will study advanced concepts in physics and computer science with special emphasis on solving problems, and explore alternative teaching strategies, for which they will receive two graduate credits from UCLA. They will interact formally and informally with eminent scientists, including a Nobel laureate.

Following the institute, participants will be given release time to conduct workshops for their colleagues to share information and teaching methodologies discussed at the institute. NSTA will prepare and disseminate a monograph based on the institute experiences to assist other teachers in setting up and running clubs and competitions.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Bill G. Aldridge	MDR 8850448
Marily M. DeWall	FY88 $202,392
Phyllis Marcuccio	FY89 $157,103
National Science Teachers Assoc	FY90 $150,602
Washington, DC	Sociology

"Curriculum Materials Development to Prepare Students and Teachers for the Downlinking of the JASON Mediterranean Expedition"

The National Science Teachers Association is working with Woods Oceanographic Institute, selected museums, and the National Council of Social Studies (NCSS) to develop instructional materials to prepare teachers and students for the satellite downlinking of Robert Ballard's JASON Mediterranean Expedition. Students (grades 4-12) will visit the museums during two weeks in April 1989 and in each spring through the year 1993 to take part in the exploration of sunken trading vessels in the Mediterranean via the "seeing eye" robot, JASON. Students will share the first views of ancient relics with the Woods Hole scientists assigned to the expedition and will be able to interact with these scientists during the simultaneous live video broadcast.

NSTA, Woods Hole, and NCSS have identified curriculum developers, teachers, supervisors, and museum coordinators who will design teaching units targeted to three levels, grades 4-6, 7-9, and 10-12. The units, containing a teachers' guide, lesson plan, and poster, will focus on the science and social studies relevant to the broad topics of underwater studies, seafaring, and trade. The materials development group will also serve as teacher trainers to the teachers who will bring their students (an estimated 24,000 in 1989) to the museums to take part in the Mediterranean Expedition. Materials will be revised each year, and a newsletter update sent to all participating teachers.

This project combines scientific and professional organizations in a concerted and unique effort to help students and teachers realize the excitement potential in scientific research. The instructional materials which are to be developed and the filming will allow future students and teachers to benefit from the JASON undertaking, and help them appreciate the multidisciplinary nature of oceanographic research and the technology which makes the expeditions possible.

TEACHER ENHANCEMENT PROGRAM

Marily M. DeWall	TPE 8552376
National Science Teachers Assoc	FY86 $117,089
Washington, DC	FY87 $143,193
	MidSch Science

"Regional Energy Workshops to Update Middle School and Junior High Science Teachers"

This Leadership Activities project for MS/JHS teachers involves the collaborative efforts of eight electrical utility companies, the National Science Teachers Association, and the National Science Foundation. It will provide a two-week summer workshop for 80 middle school/junior high school teachers at 8 regional centers served by the participating electrical utility companies (10 teachers/site), geographically distributed throughout the U.S. A regional committee of science educators will select the participants based upon a formal application and commitment of supervisory personnel in applicant school districts to support participants in follow-up efforts of curriculum implementation and in-service activities. In the proposed second year of the project, the numbers of teachers will increase to 120 distributed among 12 regional centers served by electrical utility companies.

Workshops will be staffed by appropriate utility company staff, local college and university professors, and environmentalists. A master teacher will be retained at each site to assist participants in developing classroom activities and appropriate in-service programs. Follow-up support will be available to participants from the workshop staffs.

The overall goals of the project focus on increasing the knowledge of the participating teachers in the areas of the science and technology involved in electrical energy production, including the societal, economic and environmental impacts of that production; the translation of that knowledge into appropriate activities for middle and junior high school classrooms; and the communication of that knowledge to colleagues of participants in their schools through in-service activities.

The classroom activities developed will be piloted in classrooms, revised, edited, and published so that all participants will share in the benefits of the collective efforts. National energy education resource guides and curriculum efforts will also be made available to the participating teachers.

PRESIDENTIAL AWARDS PROGRAM

John M. Fowler	TPE 8550147
National Science Teachers Assoc	FY85 $399,080
Washington, DC	FY86 $412,750
	FY87 $458,075
	FY88 $ 37,070
	Services

"Presidential Awards for Excellence in Science and Mathematics Teaching"

Following a three-year contract to NSTA for support of the Presidential Awards program, this FY88 supplement is for NSTA to initiate action on the 1988 cycle of the Presidential Awards for Excellence in Science and Mathematics Teaching (PAESMT) in the two-month period, January and February, 1988. This interim award is granted to allow sufficient time for the evaluation of responses to the RFP for services to carry out the 1988 and 1989 cycles of the PAESMT program without delaying the start of the 1988 phase. Advance publicity (press releases, printing and distribution of brochures), engagement of state/jurisdictional PAESMT directors, preparation and distribution of nomination packets, solicitation of private-sector contributions for state/jurisdictional-level recognition, and groundwork in forming state/jurisdictional selection committees are among the actions identified as necessary during the contract period.

INSTRUCTIONAL MATERIALS DEVELOPMENT

John M. Fowler	TPE 8316285
National Science Teachers Assoc	FY84 $995,455
Washington, DC	FY87 $355,775
	MidSch Science

"A Chautauqua-Type Course and Materials Development Project For Middle/Junior and Secondary School Science Teachers"

This project will focus the energies and resources of the National Science Teachers Association and of universities and other scientific institutions nationwide. Its goals are to:

- test the effectiveness of the "Chautauqua" process as a method for upgrading the science teaching skills of middle school/high school teachers in a 3-year long trial involving 16 centers;

- produce and distribute nationally teacher-produced instructional materials on such topics as Origins of the Universe and the Solar Systems, Genetics Engineering and Biotechnology, Electro- and Photo-chemistry, Plate Tectonics, Microcomputers, Elementary Particle Physics, and Robotics; and

- upgrade the science teaching skills of nearly 2,000 experienced lead teachers who will participate in the project directly and, through them, to have an impact upon thousands of additional teachers.

The effects on professional development and the teaching materials produced by the project are to be evaluated, analyzed and distributed to a national audience of precollege science teachers and those responsible for their training.

The mechanism is a Chautauqua-type short course meeting for two days in the fall and two days in the spring with a required interim project. The Centers work with local (or in some cases regional or statewide) groups of schools to identify both the teachers and their professional needs. The fall session consists of presentations on scientific topics and applications. Teacher-participants prepare course units on the topics which were analyzed and refined at the two-day workshop with an experienced teaching scientist in the spring. After classroom testing, the best of the course units will be distributed by the NSTA and other science education organizations. Topics in Astronomy, Biology, Chemistry, Earth and Space Sciences, Physics, Engineering and Technology will be included in the project.

TEACHER ENHANCEMENT PROGRAM

John M. Fowler	TPE 8850349
National Science Teachers Assoc	FY88 $305,890
Washington, DC	Recruitment

"National School Volunteer Project in Science, Mathematics and Technology"

This project will test the feasibility of recruiting, training, an deploying a cadre of volunteers who are competent scientists and/or engineers and who will work in the schools as teacher aides. Five sites, all locations of existing Triangle Coalition collaboratives, will serve as the recruiting and training centers. Science teachers from cooperating schools will specify tasks for the volunteers and will assist in conducting the training workshops.

For one academic year, the volunteers will work in the schools. During that year, data will be collected on the effectiveness of the service provided by the volunteers. The goal is to recruit a total of 25 volunteers (5 per site) who will contribute a total of 9000 hours of service (360 hours per volunteer).

The project will be conducted under the general supervision of John Fowler of the National Science Teachers Association. Significant assistance in the recruiting and training procedures will be provided by the National School Volunteer Program.

PRESIDENTIAL AWARDS FOR EXCELLENCE

John M. Fowler	TPE 8850574
National Science Teachers Assoc	FY88 $519,813
Washington, DC	FY89 $546,075
	Services

"Presidential Awards for Excellence in Science and Mathematics Teaching"

Assistance in conducting the 1988 cycle of the Presidential Awards for Excellence in Science and Mathematics Teaching (PAESMT) is to be provided by the Special Projects Office of NSTA under this contract. The principal tasks to be performed include:

1. Organizing and managing a state-by-state (and four designated jurisdictions) candidate nomination and selection process;

2. Structuring and making arrangements for a meeting of prestigious panelists to make the national recommendations;

3. Arranging travel, lodging, and a five-day program of ceremonial events, workshops, and interaction with eminent scientists and governmental officials for the 108 Presidential Awardees and invited guests;

4. Soliciting the support and cooperation of professional science, mathematics, and education societies and institutions in the PAESMT program;

5. Seeking and coordinating private-sector participation in the PAESMT program at both the state/jurisdiction and national levels;

6. Initiating preliminary action on the 1989 cycle of awards; and

7. Providing NSF-requested assistance in continuing activities of awardees.

NSTA also provides a media presentation at the Opening Ceremony of Award Week for recipients of the 1988 Presidential Awards for Excellence in Science and Mathematics Teaching. NSTA will engage Image Associates for the project; Image Associates has satisfactorily provided similar media services for the Presidential Awards program since 1985.

The presentation, scheduled for October 25, 1988 at the National Academy of Sciences, will consist of the following elements:

(1) A video interview with a scientist of national stature at his/her home base plus a personal appearance at opening ceremony in Washington, DC;

(2) A video interview with an awardee from the Washington, DC, metropolitan area;

(3) A series of brief video interviews with various-age students in the Washington area on their experiences with good science teaching;

(4) Photographic slides of awardees.

NETWORKS PROGRAM

Kenneth R. Mechling	TPE 8550171
Donna Oliver	FY85 $102,960
National Science Teachers Assoc	FY87 $ 86,638
Washington, DC	FY88 $ 10,329
	Elem Science

"Principals as Partners in the Improvement of Elementary School Science"

The primary purpose of this project is to involve the National Association of Elementary School Principals (NAESP), the Council of State Science Supervisors (CS-3), and the National Science Teachers Association (NSTA) as partners in an effort to improve elementary school science. Research on effective schools has shown that the elementary school principal is usually the key factor in the success or failure of a school to meet the needs of its students. This project, through an intensive leadership training program especially designed for principals, will prepare them as leaders and advocates for science in their own schools.

The project is divided into the following three phases. During Phase I, the project will develop a "Science Survival Kit for Elementary School Principals". This kit will include a variety of materials designed to assist principals' understanding of elementary science concepts and to help them initiate staff development and curriculum improvement activities in their schools. Phase II will include five regional leadership meetings to be held in the northeastern United States. The purpose of these meetings is to prepare state partnership teams in designing and conducting elementary school science improvement programs for principals within their respective states. Each leadership team will be composed of a state supervisor of science or a school district science supervisor and a key elementary school principal. NAESP and CS-3 will assist the Principal Investigator in forming the teams and planning the leadership meetings. During the duration of the project seventy-five leadership teams will be trained in the northeastern United States.

In Phase III each team will conduct a series of workshops in their states designed to assist principals at the local level to improve science curriculum and instruction in their schools. It is expected that this plan will reach approximately 15,000 elementary school principals. NAESP and CS-3 will be subcontractors for this project and will direct the dissemination efforts in the northeastern United States.

This project is timely and important for the following reasons:

1. It enables the key instructional leader, the principal, to play a more active and meaningful role in bringing about changes in the elementary science program in his/her school.

2. It brings together the leadership and personnel of established national organizations as partners in a cooperative venture that can affect the character and quality of elementary science programs.

3. The two-stage multiplier effect developed by this project is expected to reach approximately 15,000 elementary school principals and has the potential for being replicated throughout the United States.

NETWORKS PROGRAM

Kenneth R. Mechling	TPE 8850403
Donna Oliver	FY88 $281,710
National Science Teachers Assoc	FY89 $332,486
Washington, DC	FY90 $235,804
	Networks

"Principals for the Advancement of Leadership in Science Network (PALS Network)"

Principals for the Advancement of Leadership in Science (PALS) is a three-year project designed to establish a network of centers throughout the United States for the enhancement of science leadership among elementary school principals. The National Science Teachers Association, the National Association of Elementary School Principals, the National Science Supervisors Association, and other public and private groups will form an alliance promoting science leadership of principals. In 1988, twelve PALS Network center directors, assisted by a cadre of experienced elementary school principal consultants, will establish centers of science instruction and support for principals. Beginning in 1989 each of the centers will conduct three Regional Science Leadership Conferences for principal/partner teams, for a total of thirty-six conferences involving approximately 1,080 school administrator leaders. In addition, the PALS network sites, interconnected by computers and linked to the National Science Education Computer Network, will establish themselves as highly-visible, long-term centers of support and service for advocating science leadership among elementary school principals.

TEACHER ENHANCEMENT PROGRAM

Gary G. Allen	TPE 8652429
Native American Science Educ Assoc	FY87 $87,750
Washington, DC	Other NEC

"Building Local Science Education Resources"

This project consists of two activities:

1) An award program for teachers in Native American schools in two parts:

a) Exemplary Science Teaching Awards in a program called Research for Renewal. An award of $2,500 will be given to a teacher recommended by the NASEA Awards Committee in each of five geographical regions each year. NSF will support eight such awards over a period of two years.

b) Outstanding Awards made to successful nominees for a Field Research Expedition. Six awards of $2,000 each are to be made to teachers in the Northwest region.

2) Production of a Promising Practices and Practitioners Publication. This will be a compilation of successful science lessons that teachers in Native American schools have developed. The grant will cover the cost of assembling the material, preparing a 174-page booklet, and distributing 1000 copies to teachers in Native American schools.

Patricia A. Rose	CHEM 8608842
Pugwash USA	FY86 $65,000
Washington, DC	FY87 $17,500
	Ethics

"Choices for Our Generation: Ethics at the Cutting Edge of Science and Technology"

This award provides support for a week-long conference on "Choices for Our Generation: Ethics at the Cutting Edge of Science and Technology." Selected in a national competition, 90 outstanding students from diverse disciplines meet with senior leaders from academia, industry, government and non-profit organizations for small group discussions as well as general plenary sessions with keynote addresses by nationally-known figures. The conference then focuses attention on the ethical choices students face as they move into positions of increasing responsibility. Applicants prepare papers on specific topics where scientific and technological research and development affect and are affected by these choices; these papers serve to focus the small group discussions during the week. Publication and follow-up activities will reach university students nationwide; the academic science, technology and society (STS) community; science and technology practitioners and policy-makers; high school teachers; and interested members of the general public.

This supplement releases additional funds of $17,500 matching additional support obtained by the grantee from new sources.

This project is funded jointly with the Directorate for Mathematics and Physical Sciences.

Pam Seidenman	MPS 8813091
Pugwash USA	FY88 $95,557
Washington, DC	FY89 $33,215
	Ethics

"New Challenges Posed by Global Interdependence -- 6th Biennial Student Pugwash USA Conference on Science, Technology, and Ethical Responsibility, June 1989"

This award provides partial support for an international conference and related projects at colleges and universities on issues in science, technology, and ethical responsibility. The theme of these projects is "New Challenges Posed by Global Interdependence." They will examine ethical and value issues raised by global interdependence in four areas: environmental science, bioengineering, information science, and global security. The conference will bring ninety outstanding students from diverse disciplines and nations together with leaders of varying perspectives in academia, government, industry, and non- profit organizations. Conference participants will prepare research papers, to be published in academic and professional journals, which will serve as the focus of small working group discussions during the week of the conference. The conference will also feature plenaries by national figures. In conjunction with the conference, Student Pugwash chapters, currently active on forty-three college and university campuses, will sponsor educational events -- symposia, roundtables, lectures, debates, and an ongoing electronic conference -- on issues in global interdependence. An evaluation will be developed and conducted. Private foundation and corporate sponsors will provide over two- thirds of the funds for this effort.

The scope and organization of this activity are highly meritorious; it has evolved into a truly unique national, even international, student educational effort on science, engineering and social responsibility. The institutional sponsor has an excellent track record. Matching support has been received and will continue to be received from several corporate and private foundations. For the first time, a campus chapter program has been linked to the conference, and an evaluation is being planned. These project components have great potential to augment and improve what has been a very successful endeavor.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

INSTRUCTIONAL MATERIALS DEVELOPMENT

E. G. Sherburne	RCD 8652478
Science Service Inc	FY87 $30,000
Washington, DC	FY88 $20,000
	FY89 $10,000
	Services

"Support of the 6th Annual (1987) Directory of Science Training Programs for High Ability Precollege Students"

This award to Science Service, Inc. will permit continuation of a three-year project initiated in 1987. Science Service will prepare, publish and disseminate an annual Directory of Science Training Programs for High Ability Precollege Students. As many of the participants in projects listed in this directory make or confirm career choices in science as a result of this experience, it is clearly in the national interest to encourage the continuation of this publication.

Science Service has been seeking other ways of underwriting publication costs. Advertising was accepted in the Directory for the first time in an experiment to determine whether it could ultimately provide continuing support for the publication of the Directory. The initial response, which generated $6,500, suggests that this is a definite possibility. This enabled Science Service to increase the number of Directory entries by 13%, and the print run and distribution by 50%.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Edward V. Lee	MDR 8751111
The National Learning Center	FY88 $236,835
Washington, DC	FY89 $243,705
	Elem Science

"Prototype Learning Laboratory Extension"

The National Learning Center (TNLC) will incorporate informal learning with self-directed, engaging materials. TNLC has produced, with a three year grant, a multimedia elementary science learning Lab that uses tabletop exhibits to create a mini-museum for students in grades four through six. The additional two years of funding will enable the project to produce and field test four new Learning Lab units and two related educational software packages. Each unit will consist of about fifteen tabletop exhibits, student workbooks and a Teacher's guide. Delta Education, Inc. will work closely with TNLC to ensure that each new unit will become commercially available and will provide teacher-training.

FLORIDA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Roderick S. Dickens, Jr.
Science
N B Forrest High School
Jacksonville, FL

Susan A. Englert
Mathematics
Largo Senior High School
Largo, FL

1988

Betty M. Larkin
Mathematics
Pine Island Middle School
Bokeelia, FL

Jane Nelson Bray
Science
Boone High School
Orlando, FL

COLLEGE SCIENCE INSTRUMENTATION

Reggie L. Hudson	USE 8851650
Eckerd College	FY88 $10,000
Saint Petersburg, FL	Chemistry

"Introduction of Fourier Transform Infrared Spectroscopy into the Chemistry Curriculum"

Fourier Transform Infrared Spectroscopy is being introduced into the chemistry curriculum. The project centers on a modern FTIR spectrometer, FTIR accessories, and a dedicated microcomputer. The equipment is being used with old experiments as well as with new ones designed to illustrate modern infrared spectroscopy. Students from the introductory laboratory courses to the advanced, integrated laboratory courses and thesis research projects are using the FTIR instrument. It is likely that it will become the chemistry department's most heavily used spectrometer, replacing three unreliable vacuum-tube instruments. Students are able to characterize unknowns and synthesized materials faster and with greater confidence. Studies of "real world" samples are being facilitated as well as the investigation of reaction rates and molecular structure. Since FTIR methods are finding increased use in government, industrial and academic laboratories, students are better prepared to enter the workforce, graduate schools, and professional schools because of this project.

The grantee is matching the award from non-Federal sources.

YOUNG SCHOLARS

Phillip B. Horton	RCD 8850191
Florida Institute of Technology	FY88 $39,750
Melbourne, FL	FY89 $39,750
	Environmental

"Project Earth: An Environmental Study of Florida and the Great Smoky Mountains"

Project Earth: An Environmental Study of Florida and the Great Smoky Mountains is a four week residential summer program for eighteen 11th and 12th grade students from the southeastern United States. The program includes a combination of college-level instruction on the campus of Florida Institute of Technology, with camping, hiking and field work in the Great Smoky Mountains National Park, Tennessee.

Program participants learn basic concepts of environmental science and terrestrial ecology, and apply these concepts in laboratory and field studies. The laboratory and field studies focus on comparisons between the biotic and abiotic factors of various naturally occurring ecological communities.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

George O. Dawson	MDR 8751355
David D. Redfield	FY88 $1,393,402
Florida State University	FY89 $1,346,653
Tallahassee, FL	FY90 $ 485,223
	Mid School Science

"Interactive Middle-Grades Science"

The Interactive Middle Grades (IMS) Project will apply many of the recommendations for change in science education to the critical middle grades. Florida State University at Tallahassee and Houghton Mifflin Company will develop a science program for grades six through eight that will meet the diverse needs of today's teachers and students. IMS will integrate teachers, textbook and laboratory with applications of the micro- computer and the laser videodisc, producing a commercially marketable system for science instruction, classroom management and student evaluation. Science content, processes and skills focusing on appropriate problems of science, technology and society will be integral parts of the program. This joint effort will involve professional societies, distinguished science educators and will be consistent with guidelines offered by the National Science Teachers Association and National Association of Secondary School Principals. The partner in this project is the Educational Software Division (ESD) of Houghton Mifflin Company.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Edward K. Mellon	MDR 8751183
Florida State University	FY87 $72,516
Tallahassee, FL	FY88 $26,552
	Chemistry

"Reviews of Chemical Reactivity for School Science Teachers"

The purpose of this project is the collection and publication of at least twelve reviews covering the descriptive inorganic chemistry of the most important elements and their simple compounds, both in the pure state and in aqueous solution. The reviews, for the most part, will be published in the Journal of Chemical Education. They will later be collected in reprint volumes for teachers.

The reviews are being modeled on the curriculum developed by W. C. Bray and W. M. Latimer, "A Course in General Chemistry". The general characteristics of the reviews include: coverage of the chemistry of everyday materials rather than esoteric compounds; inclusion of laboratory exercises and demonstrations graded as to suggested usage level; description of safety and waste disposal methods; and de-emphasis of heavily theoretical models in comparison with qualitative models.

In conjunction with the project, a Policy Group, consisting of chemical educators from both higher education institutions and secondary schools is being formed. A second group, the Reactivity Network, will consist of highly qualified secondary school chemistry teachers who will serve on writing teams and give presentations about the review program at professional meetings.

This project will address a serious shortcoming in precollege chemical education by providing materials focused on descriptive chemistry, an area largely ignored in current texts. Secondly, it will help to modify the present approach to laboratory work in that the laboratory activities will become the central feature of the materials, and will involve the solution of problems rather than the performance of illustrative experiments.

COLLEGE SCIENCE INSTRUMENTATION

James S. Browder	USE 8853090
Jacksonville University	FY88 $17,747
Jacksonville, FL	Physics

"Electro-Optics Laboratory in Undergraduate Physics"

The grantee will purchase a spectrum analyzer system, an optical spectrometer, a photopolarimeter, a fiber optics system, components for a Michelson interferometer, and a portable personal computer. This equipment will be used to improve instruction through the implementation of a new laboratory course in electro-optics for upper-division physics majors. A unique feature of this program will be the construction of some of the equipment for the course by advanced students as special projects.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Steven Radak	USE 8852871
Miami-Dade Community College	FY88 $11,500
Miami, FL	Chemistry

"Curriculum Development of Laboratory Courses through Atomic Absorption Spectrophotometry"

The community college offers the first two years of science and engineering curriculum heavily relying on traditional methods of analysis and theory. Most modern laboratories rely on sophisticated instrumental analysis. Therefore with the acquisition of an Atomic Absorption Spectrophotometer, the students are being better equipped to enter their junior year in a senior institution with skills that are demanded for proficiency in their career. This project is providing lower level students access to the actual "hands on" instrumental analysis and solution preparation. In addition they are gaining experience in the assessment of the quality of laboratory generated data which will assist with developing problem solving skills required in any life situation.

The grantee is matching the award from non-Federal sources.

COURSE AND CURRICULUM

J. Douglas Child	USE 8814048
David C. Kurtz	FY88 $73,436
John J. Bowers	FY89 $43,126
Rollins College	FY90 $44,975
Winter Park, FL	Mathematics

"The Design of a Computer Algebra System to Effect a More Relevant Mathematics Curriculum"

The focus of this three year project at is the construction of a computer environment -- consisting of a computer algebra system - MAPLE, a specially designed interface to MAPLE, a hypertext system, and other software --- that is more suitable for teaching and learning calculus for the average student.

This computer algebra system will demonstrate the reasoning processes of experts. The intent is that students will learn how to think about solving calculus as well as how to solve problems with the help of a computer algebra system. This computer environment is suitable for pre-calculus, science and engineering curriculum designs.

The calculus topics will be reordered. Differentiation and integration will be introduced early in the course via applied problems. There will be an emphasis on logic, precise use of language, numerical methods, approximations, and mathematical modelling.

Experimental use of materials is planned at colleges and local high schools which have classes of approximately thirty-five students. National dissemination will be in the form of text to be published.

The grantee institution is contributing one-fourth of the project's cost with in-kind services.

COLLEGE SCIENCE INSTRUMENTATION

J. Douglas Child	USE 8852244
Rollins College	FY88 $46,528
Winter Park, FL	Mathematics

"The Design of a Computer Algebra System to Effect a More Relevant Mathematics Curriculum"

This project will modify computer algebra systems (CAS) to make it a more suitable, usable learning tool for calculus and then pre-calculus students. The Principal Investigator is the first person to develop a prototypical intelligent tutoring system and a Macintosh graphic interface to Maple.

The proposed new computer technology and curricular revisions will be the basis for faculty retraining and teaching of experimental applied calculus, pre-calculus, and summer workshops for secondary school teachers at Rollins College. The equipment will be used for a computer laboratory components, and faculty desktop access to CAS.

Two of the senior staff have received grants from the Sloan Foundation to develop CAS. The grantee is providing an equal sum for the equipment obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Stephen Klemann	USE 8750272
Rollins College	FY87 $12,700
Winter Park, FL	Biology

"A Liquid Scintillation Counter to Improve Undergraduate Instruction in Cellular and Subcellular Biology"

Recent developments in technology now enable biologists to study organisms at the cellular and subcellular levels. This new field of Molecular

Biology promises to answer many previously unanswered questions about, e.g., regulation physiology and the development of organisms. Use of radioactive isotopes for the labeling and tracing of molecules has proved invaluable in Molecular Biology -- a technique which requires the new liquid scintillation counter provided through this award.

Actual experience with radioactive labeling and scintillation counting is helping the students better understand new concepts and developments in Biology. By incorporating labeling experiments into the study of plants, animals and bacteria, the universality of cells is being stressed, thus demonstrating how modern techniques may be applicable to diverse sets of organisms and disciplines. Through this experience the students are receiving practical training in the use of modern biological instrumentation, and are improving their skills in understanding and solving biological problems.

COLLEGE SCIENCE INSTRUMENTATION

Brian G. Ramsey USE 8750373
Rollins College FY87 $20,800
Winter Park, FL Chemistry

"Fourier Transform Infrared Spectroscopy in the Chemistry Curriculum at Rollins College"

The acquisition of a computerized Fourier Transform Infrared (FTIR) Spectrophotometer by the Chemistry Department of Rollins College is significantly improving undergraduate instruction by making possible the addition of several new experiments to the laboratory curriculum. The new system increases the efficiency with which principles of spectroscopy are taught in organic and inorganic chemistry courses; students are able to quickly characterize and identify unknown compounds or products from synthetic reactions. Finally, students receive instruction incorporating the use of a modern analytical instrument with computerized data acquisition and manipulation.

COLLEGE SCIENCE INSTRUMENTATION

Robert H. Peterson USE 8851263
St Leo College FY88 $5,300
Saint Leo, FL Biology

"Improved Laboratory Instruction in Biology and Chemistry with Modern Ultraviolet-Visible Spectroscopy"

A modern ultraviolet-visible recording spectrophotometer and an electronic analytical balance are used to improve courses in Cell Physiology and Organic Chemistry. In Cell Physiology, experiments in protein characterization, enzyme kinetics, DNA quantitation, and chromatographic purification and assay of egg white lysozyme are upgraded. In the Organic Chemistry laboratory, ultraviolet-visible spectroscopy enhances student understanding of the relationship of structure to spectra, the determination of the distribution of coefficients of ketones, and the study of the spectral consequences of hydrogen bonding.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Richard Schwartz USE 8852354
Santa Fe Community College FY88 $26,411
Gainesville, FL Chemistry

"Improvement of the General Chemistry Curriculum Through Simulations and Modern Equipment"

The curriculum is being enhanced by the establishment of a dedicated microcomputer laboratory component to supplement and expand the present laboratory exercises taught in the chemistry courses. Twenty computers, two printers, two plotters and the requisite software are being purchased. The equipment is being used to reinforce experiments; to familiarize students with modern analytical techniques by using computer simulations, particularly in areas where expensive instrumentation is not available; and to provide numerous samples for examination and analysis to supplement experiences in the laboratory. The additional laboratory training is helping students gain further knowledge and experience necessary for successful entry and completion of upper division curriculum. Students are also increasing their competency and familiarity with computers, a basic tool of modern science and industry.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Theodore W. Beiler USE 8750720
Stetson University FY87 $6,974
Deland, FL Chemistry

"Instrumentation in the Microscale Organic Laboratory"

Instrumentation appropriate for use in a microscale organic laboratory has been recently acquired by the Chemistry Department at Stetson University. This includes toploading electronic balances for rapid and accurate weighing of milligram quantities, an infrared spectrophotometer for identification of small quantities, a recorder for a gas chromatograph to provide rapid analysis of volatile samples, and a refractometer for rapid assay of liquid fractions. Conversion of the laboratory to microscale increases student efficiency in laboratory operation, permits more sophisticated laboratory reactions, increases the number of experiments, increases the interest in and retention of principles, markedly cuts the annual expense for chemicals, and decreases laboratory air pollution and the amount of toxic chemical waste disposal.

COLLEGE SCIENCE INSTRUMENTATION

David Lawson	USE 8750568
Stetson University	FY87 $21,255
Deland, FL	Computer Science

"The Upgrade of a DEC Microvax II to an Undergraduate Laboratory Teaching Tool"

Under this project, the principal investigator will upgrade an existing DEC Microvax II to provide an undergraduate teaching laboratory. With the addition of a 159 megabyte disc, port selector, and upgrades to existing Rainbow terminals, sixteen students will be accommodated. Three upper division courses, Operating Systems; Assemblers, Compilers and Translators; and Computer Graphics will be served by the upgraded laboratory. In addition to the formal courses, the laboratory will provide a base for experimentation by an undergraduate student research group doing research on modeling and cognitive science. Among the experiments planned for research are neural network simulation, pattern recognition of video frames, and Sejnowski's Nettalk experiment. The intent will be to create hypothetical neural structures and then examine their performance.

COLLEGE SCIENCE INSTRUMENTATION

Thomas A. Lick	USE 8851575
Stetson University	FY88 $13,730
Deland, FL	Physics

"Computer Based Data Acquisition and Plotting Introductory Laboratory Experiments"

The grantee will purchase personal computers, digital plotters, and data acquisition modules. This equipment will be used to improve instruction in Introductory Physics laboratory courses. Students will learn basic techniques of computer-controlled data acquisition and analysis, and will study basic physical phenomena that are too fast for measurement by traditional techniques.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Gareth Williams	USE 8851567
Stetson University	FY88 $30,390
Deland, FL	Mathematics

"The Completion of a Microcomputer Network"

This project will establish a campus microcomputer network for students and teachers to access computing resources and software at Stetson University. The network will be linked with national networks. A modern teaching environment adapting the latest software for students and teachers will be established to explore ways of learning and applying mathematics. The curriculum of calculus, linear algebra, differential equations, and chaotic dynamical systems will be enhanced by this network. There will be an internal and external evaluation of the effectiveness of the network and curriculum impact.

The grantee is providing an equal sum for the equipment obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Charles W. Nelson	TPE 8751186
University of Florida	FY87 $66,135
Gainesville, FL	FY88 $61,912
	Mathematics

"University of Florida Honors Workshop in Mathematics"

This two-tiered northern Florida junior/senior high school program matches 10 leader mathematics teachers with 20 minimally prepared mathematics teachers (on a one-to-two basis) in order to strengthen/broaden the mathematical background and to improve the teaching skills of all the teachers. The workshops, in the summers of 1987 and 1988, will consist of two intense five-week programs running concurrently and separately, but overlapping in a seminar meeting three times per week for all teachers and four faculty members. During the academic year there will be visits to the teachers' classes and two mini-conferences.

The courses (tailored to the mathematical experiences of the teachers) will use the problem solving approach and include computer/information sciences. The underprepared teachers will focus on algebra, geometry, measurement, and probability. Other topics will include logic, linear programming, game theory, calculus (upon request), and teaching strategies. Moreover, the leader teachers will develop mentor skills.

The University of Florida is awarding 7 credits for these courses. The teachers will come from Central Crown school districts in northern Florida. There is significant cost sharing from the Florida Department of Education and the University of Florida.

TEACHER ENHANCEMENT PROGRAM

Mary B. Rowe	TPE 8850439
University of Florida	FY88 $51,616
Gainesville, FL	Elem Science

"Supervisor Workshop for K-8 Curriculum Improvement Using CD-ROM"

The University of Florida will conduct a four-day workshop during which fifty State Science Supervisors, or their designees, will use a new technology known as CD-ROM to increase the amount and appropriateness of hands-on activities in K-8 science. One thousand lessons which provide student experiences and were produced by NSF-funded projects (ESS, SCIS, SAPA, MINNEMAST, COPES, USMES, and ESSP) have been collected, analyzed, abstracted and stored on a compact disk during a 1984-1987 Carnegie project. A powerful search system allows rapid and selective use of lessons through criteria such as grade level, science processes, subject, vocabulary words and content themes. Lessons are in the public domain and can be printed.

Workshop materials will be based on results of a pilot program in ten Florida school districts and workshop personnel are from the program and the original CD-ROM project.

Though no dollar figure is attributed to the cost-share, the University, through their School of Architecture, is providing sufficient computers so that there will be one available for each two participants.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Mary B. Rowe	MDR 8751326
University of Florida	FY88 $502,959
Gainesville, FL	FY89 $524,305
	FY90 $388,982
	Elem Science

"Self Help Elementary Level Science (SHELS)"

The technology-based "Self Help Elementary Level Science" (SHELLS) package is a three-year project to help teachers and administrators integrate science into their elementary programs.

Twelve major obstacles to doing science in the elementary school have been identified and strategies have been designed for dealing with them through video and audio tapes and print materials. One set of video and audio tapes will show what to do to minimize or reduce the obstacles. Another set will teach basic physical science concepts. A third set will be explicitly helpful to administrators. In addition, experienced elementary teachers will model how to put them into practice with research based teaching examples.

Thirteen video and six audio tapes with print materials will be developed. The intent is to provide administrators and teachers with instructional tapes to be used as a stand alone inservice program by individual teachers and principals or as a supplement to inservice and preservice activities conducted by trained leaders.

Video production laboratories in the Colleges of Engineering, Medicine and Education at the University of Florida and at the Association for Supervision and Curriculum Development (ASCD) in Virginia will collaborate in the making of the tapes with scientists, supervisors, administrators and teachers from twelve institutions and districts.

The Association for Supervision and Curriculum Development, which has extensive experience in video education, publications and institutes for administrators and teachers, will be the publisher of the SHELLS project and will take major responsibility for dissemination. The National Science Teachers Association will collaborate in dissemination, as will the National Association of Elementary School Principals.

COURSE AND CURRICULUM

Shair Ahmad	USE 8813860
University of Miami	FY88 $45,000
Miami, FL	Mathematics

"Calculus Workshops and Conferences"

The proposal is for a planning project that will hold a monthly series of two-day conferences and workshops on Calculus to be attended by universities, community colleges, and high school calculus instructors -- as well as industrial representatives. The effort will be headed by an extremely able and accomplished mathematician. It will include mathematics faculty members from the University of Miami, Dade County Community College and the Dade County Public Schools. The seminars will concentrate on the role of computers and calculators, textbooks, relevance to other disciplines, conceptual understanding, and developing exercises that stress current day technology. The discussions will be led by small groups of well- prepared individuals familiar with the existing literature on the subjects. The participants will be encouraged to carry on similar discussions in their own institutions.

TEACHER ENHANCEMENT PROGRAM

Stewart W. Schneller	TPE 8652386
Thomas C. Wilson	FY87 $145,104
University of South Florida	Chemistry
Tampa, FL	

"A Common Chemistry Telecourse"

The University of South Florida will produce videotaped lessons on chemistry for the use of preservice elementary school teachers and inservice middle school and high school teachers who are not adequately prepared in chemistry. Three tapes, focusing on density in solids, liquids, and gases, will attempt to convey fundamental science concepts without extensive use of mathematics. A fourth tape will provide material on effective instructional methods for the benefit of the instructors using the three instructional tapes.

These tapes will be distributed to inservice teachers of grades five through eleven in southern Florida and to preservice teachers in the Suncoasts Area Teacher Training program. These teachers will be asked to complete pretests and posttests on the scientific content of the tapes and feedback on the effectiveness of the lessons. In addition, the tapes will be broadcast on channel 16 in Tampa (WUSF), and efforts will be made to evaluate their impact on the viewers.

COLLEGE SCIENCE INSTRUMENTATION

Clifford W. Chang USE 8750196
University of West Florida FY87 $25,708
Pensacola, FL Chemistry

"Mass Spectrometry as an Instructional Tool in the Undergraduate Laboratories"

A gas chromatograph/mass spectrometer (GC/MS), which has recently been acquired by the Chemistry Department of the University of West Florida is finding application in six undergraduate courses and in directed student research. Courses in basic organic chemistry, with a variety of majors, and advanced organic chemistry, with chemistry and allied health science majors are significantly enhanced by the availability of this system. Students are enabled to collect and evaluate firsthand data as, for example, (1) separating and identifying halocarbons by examining the molecular ions formed, (2) differentiating between isomers such as methyl p-hydroxybenzoate and p-methoxybenzoic acid by examining the fragmentation ions, (3) preparing and analyzing volatile organometallics, and (4) evaluating water supplies for organic contaminants.

COLLEGE SCIENCE INSTRUMENTATION

Grace Chiu USE 8851668
University of West Florida FY88 $21,418
Pensacola, FL Chemistry

"Thermal Analysis Equipment for Undergraduate Laboratory Instruction in Chemistry"

A new laboratory course in Polymer Chemistry is being introduced with the acquisition of a thermal analysis system for differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). The equipment is also being used in five undergraduate courses covering analytical, inorganic, organic, and physical chemistry. The equipment is being utilized to expand the offerings in undergraduate research. Sophomore, junior, and senior students are studying the properties, structure, and reactions of a variety of compounds using thermal analysis as a probe. The thermal analysis instrumentation provides a dual benefit in improving the course offerings and updating the instrument holdings to enable the characterization of polymers. Instruction in polymer chemistry in the undergraduate curriculum has been neglected in many institutions. With the thermal analysis system with DSC and TGA capabilities, new experiments can be introduced throughout the curriculum meeting the recommendations of the Committee on Professional Training of the American Chemical Society in this important area.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Theodore F. Elbert USE 8750068
University of West Florida FY87 $47,179
Pensacola, FL Computer Science

"The Establishment of an Undergraduate, Real-time, Embedded System Software and Interfacing Laboratory"

This project establishes an integrated laboratory to support instruction in three areas. They are: (1) Development of software that must function in a real-time, embedded system environment; (2) The interfacing of embedded computers to their external environment; and (3) The relationship between embedded systems and the external environment.

The laboratory will consist of six Motorola VME-10 microcomputers that can be interconnected and/or networked through individual, serial or parallel devices or through an IEEE-488 bus. The VME-10 computers will be used both singly and in combination to control plants simulated by COMDYNA analog computers.

COLLEGE SCIENCE INSTRUMENTATION

George H. Stopp, Jr. USE 8852720
University of West Florida FY88 $9,554
Pensacola, FL Geography

"Enhancing Computerized Cartographic Instruction in an Undergraduate Geography Program"

This project establishes a capability in computer assisted cartography in the Geography program. Computer assisted cartographic techniques and processes are an integral part of several undergraduate geography courses, significantly enhancing the level of learning among both geography majors and other students who look to Geography as a corollary science to their major discipline. In addition to integration of the equipment into four technique courses, computer assisted cartography is introduced as a discrete learning unit into the entire array of geography courses, thus serving a wide audience from the entire University. The goal is to provide students with an opportunity for hands-on experience with computer assisted cartographic techniques and to allow them to participate in the expanded geographic analytic processes associated with these techniques.

The award will be matched by an equal amount from the grantee.

GEORGIA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Pamela W. Coffield
Mathematics
Brookstone School
Columbus, GA

Daniela M. Taylor
Science
Norcross High School
Norcross, GA

1988

Ralph D. Stewart
Mathematics
Heritage High School
Conyers, GA

Jeffrey D. Cramer
Science
Ronald McNair Senior High School
Atlanta, GA

COLLEGE SCIENCE INSTRUMENTATION

Elizabeth Bottomley	USE 8852283
Agnes Scott College	FY88 $16,132
Decatur, GA	Chemistry

"Improvements in Molecular Emission Experimentation at the Undergraduate Level"

The students' basic understanding of molecular emission phenomena and the measurement applications which contribute to knowledge of excited states and energy transitions is being improved. Through the use of a computer-controlled luminescence spectrophotometer and a stopped-flow accessory, new experiments are being incorporated in organic, biochemistry, and physical/analytical laboratories for both majors and non-majors. Students in lower and upper division courses are having an enhanced experience with fundamental principles of excitation-emission, chemiluminescence, intermolecular energy transfer, excited-state lifetimes, and analytical applications of luminescence in elucidating biochemical reactions. The undergraduate research program is also being facilitated, as well as a secondary school chemistry teacher's Staff Development Program under the auspices of a grant from the State of Georgia Department of Education. The entire project is promoting a significant advance in unifying concepts related to structure and energy transitions.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Harry Wistrand	USE 8852671
Patricia M. White	FY88 $32,545
Agnes Scott College	Biology
Decatur, GA	

"Instructional Equipment to Improve Undergraduate Molecular and Cellular Biology Laboratories"

To provide students with experimental knowledge of key aspects of cellular structure and function, this department is adding laboratory exercises to its Cellular and Molecular Biology programs. Laboratory work is being provided for the first time in conjunction with Molecular Genetics; a project in molecular genetics is being added to Microbiology; improved experiments in cellular biochemistry, respiration, and photosynthesis are being introduced into the Cellular Physiology and Biochemistry laboratories.

These laboratory improvements required the new equipment that is being provided through this project. The equipment includes: gel electrophoresis and blotting equipment, a sequencing gel reader, two centrifuges, a refrigerator, a -70°C freezer, water baths, a gel photographic unit, an analytical balance, a table-top autoclave, an orbital platform shaker for gel staining procedures, a microprocessor-controlled UV-visible spectrophotometer, a tissue homogenizer, and oxygen-monitoring systems.

With this equipment, students can do investigations in areas previously studied only through lectures and reading. The combination of theoretical and experimental understanding of cellular biology made possible by the new laboratory activities provides preparation essential to their pursuit of advanced degrees and careers in the life sciences.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Surendra N. Pandey	TPE 8751871
Albany State College	FY88 $273,238
Albany, GA	Physics

"Professional Development and Enrichment Program for Physics and Physical Science Teachers of Grades 7-12"

This is a 39-month program for underprepared physics and physical science teachers from the area surrounding Albany, Georgia. This program will provide significant content and pedagogical training in physics for 16 high school physics teachers, and similar training in physical science for 16 junior high school teachers. Teachers selected for the program will participate in a series of three six-week summer workshops together with academic year follow-up activities. Graduate credit will be available for each summer workshop completed. The workshops are intended to equip the participants to serve as resource teachers in physics or physical science in their schools and school districts. Albany State College is a traditionally black institution. This program is expected to serve a substantial number of minority teachers.

TEACHER ENHANCEMENT PROGRAM

David C. Robinson	TPE 8751308
Albany State College	FY87 $ 97,402
Albany, GA	FY88 $107,397
	Environmental

"Ecological Institute for Improving Science Education"

An analysis of need of groups revealed that science teachers need additional training to effectively teach ecological concepts, principles, related process skills and environmental issues to their students. To help meet this specific need, an ecological institute is being offered for twenty-five middle grade and high school teachers per year for two years. The proposed objectives of the institute are: (1) To develop and assess a course in ecology for science teachers that emphasizes acquisition of concepts, principles, and inquiry processes; (2) To teach the course to selected teachers using the Keller Plan and modular techniques for acquiring an understanding of environmental issues, ecological knowledge, and process skills; and (3) To provide the teachers with ecological activities that permit "hands-on" experiences in studying, collecting, identifying and preserving terrestrial and aquatic organisms.

To ensure the achievement of the objectives, the institute will be conducted each year for six weeks during the summer and at several one-day events during the academic year. The institute will be composed of two segments. The first will occur on the Albany State College campus and on Sapelo Island, Georgia. During the first four weeks of the summer, participants will be engaged in the modular/ discussion part of the course, including laboratory activities. The last two weeks will involve activities conducted at Georgia Marine Institute on Sapelo Island. The second segment of the institute (workshops) will be conducted at the schools of the participants during the following academic year. During this time, the institute staff will teach ecological concepts and process skills of the institute to the in-service teachers' colleagues. Additionally, at these workshops, the staff will conduct local field trips for the teachers, and provide advice to them while they develop teaching materials that reflect information learned at the institute.

CAREER ACCESS OPPORTUNITIES

Melvin R. Webb	USE 8850618
Clark College	FY88 $720,000
Atlanta, GA	FY89 $800,000
	FY90 $800,000
	FY91 $800,000
	FY92 $500,000
	Minority Centers

"The Atlanta Comprehensive Regional Center for Minorities"

This project involves a cooperative effort among the institutions of the Atlanta University Center (Atlanta University, Clark College, Morehouse College, Morris Brown College, and Spelman College), together with Georgia State, Georgia Tech and the Atlanta Public Schools. It consists of a set of coordinated activities, targeted initially throughout Metropolitan Atlanta, designed to significantly increase the representation of minorities in careers in science, engineering and technology. The broad-based approach taken to solve the underrepresentation problem centers on the establishment of coalitions among colleges, public schools and community organizations. The activities include formal education during the precollege and undergraduate years and informal science education for all ages from early childhood through the adult years. A set of coordinated activities are being implemented, with responsibilities distributed among the several institutions and organizations. For example, Saturday Science Academies for elementary students will be established at several of the institutions (patterned on the model developed at Clark College) and summer enrichment institutes will be taught by teams of faculty from the Atlanta University Center, Georgia State and Georgia Tech. At the undergraduate level, Georgia Tech will play the lead role in a six-week summer enrichment program for minority students in engineering following their freshman year, while Georgia State, with a major role in teacher education, will be responsible for developing and implementing the 5-year MAT and M.S. programs. The informal science education component, developed cooperatively with other Atlanta groups, e.g. APPLE Corps and Zoo Atlanta, involves a number of activities such as: "Science is for Everybody" consisting of portable learning units based on permanent exhibits from Atlanta's major science/technology centers; Science and Technology Programs for Boys Clubs and Girls Clubs; and Community Forums on Effective Schools. A central project focus is on instructional strategies which will nurture, encourage and motivate students within the context of science experiences.

This project is an excellent example of a Comprehensive Regional Center for Minorities. It is targeted at a minority population of substantial size (600,000), and it is comprehensive in terms of attention to the various educational levels and age groups, in disciplinary coverage, in coordination and cooperation among school systems, colleges and universities and community organizations, and in its focus on nurturing, encouraging and motivating minority students. Significant additional financial support is being contributed to the project by the participating organizations and groups.

YOUNG SCHOLARS

George E. Stanton	RCD 8850264
William S. Birkhead	FY88 $42,598
Glenn D. Stokes	FY89 $42,598
Columbus College	Ecology
Columbus, GA	

"Science Challenge"

The Science Challenge Program of Columbus College is designed to expose science students (9-12 grades) to scientists in a variety of disciplines and to provide opportunities for questioning, experimental design, sampling, management of data, analysis of results, drawing inferences and presentation of findings.

Using stream ecosystems as an operational milieu, participants take measurements, use instrumentation, and topographic maps, exercise personal leadership, employ personal computers as research tools, design studies, collect and process samples, manage results, design tables and graphs, draw inferences, and report findings. Three faculty provide careful, individualized guidance throughout the project. Ideas regarding scientific ethics and career opportunities in science are woven into the fabric of the 6-week program. Faculty, who possess a record of effective work with female and minority students will make an assertive effort to maximize participation by these populations which are poorly represented in scientific professions.

COLLEGE SCIENCE INSTRUMENTATION

G William Donaldson	USE 8852380
Emanuel County Junior College	FY88 $9,478
Swainsboro, GA	Chemistry

"Enhancing Freshman Chemistry"

The instruction in General Chemistry is being improved by using technology which permits interaction by the students. An integrated system consisting of two computers connected to laser disc players with special touch sensitive monitors have been added to the chemistry instructional program. The technology is providing remedial instruction for the marginal students, supplemental instruction for the better students, and laboratory simulations for all of the students. As a result, students are having experiences that were not previously possible.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Robert J. Jensen	TPE 8751325
Emory University	FY89 $95,852
Atlanta, GA	FY90 $95,838
	Mathematics

"A Teacher Enhancement Model for Integrating Computer Microworlds into Middle Grade Mathematics"

This three-year collaborative between Emory University, Atlanta Public Schools and IBM will develop a prototypical model for teaching middle school teachers to incorporate mathematical/ computer microworlds into the mathematics curriculum. Each year teams of three teachers from five middle schools will participate. Thirteen of the 15 teachers will be minorities.

The teachers will participate in an intense three-day session at IBM, two half-day monthly meetings during the academic year, and, with on-site assistance of Emory staff, use the computer microworlds in their regular mathematics classes. Five of these teachers will be chosen to be mentors to the fifteen new teachers of the next year. During the third year, the project will be taught by the Atlanta Public School teachers and staff.

Anticipated project products include curriculum materials integrating microworlds into the mathematics curriculum, teachers development training materials, and complete descriptions of all project activities so that the project can be replicated.

COLLEGE SCIENCE INSTRUMENTATION

F. Jalali	USE 8750539
Fort Valley State College	FY87 $18,570
Fort Valley, GA	Electrical Eng

"Data Acquisition Workstations for the Undergraduate Linear Circuit Laboratory"

This project will equip an advanced electronic laboratory with six experiment stations. Each station will contain an IBM PC/XT, a Keithley Data Acquisition System and a Digital Multimeter with analog outputs. The stations will allow very rapid data collection, leading to an increase in the number of experiments that the students will be able to perform. Rapid data collection will also allow the students to examine the circuit characteristics as the parameters are changed resulting in a fuller understanding of the design of circuits.

YOUNG SCHOLARS

Sauveur Mahotiere	RCD 8850086
Mark Latimore	FY88 $38,100
Charles Magee	FY89 $38,100
Fort Valley State College	Life Sciences
Fort Valley, GA	

"Young Scholars Project for High Ability and High Potential Secondary High School Students"

The objectives of this Young Scholars project are to prepare and motivate minority high school juniors and seniors, including women and the disabled, for college education leading to advanced degrees and/or professional careers in science, agriculture, and engineering. Summer activities over an 8-week period include: (1) A 3-day orientation with a roundtable discussion on career opportunities, involving the students, the project staff and representatives from academic, public and private institutions involved in research and/or development in chemistry, physics, engineering, agriculture and other science-related areas; (2) Pre-college classes and laboratories involving all participants and designed to enhance their interest in and knowledge of pre-calculus, chemistry, physics, elementary statistics and computer use; (3) Research and/or scientific exercises in the areas of agricultural engineering, plant and soil sciences, agricultural economics and rural sociology, and animal science; and (4) Field trips focused primarily on academic, public and private institutions involved in research and/or development. Each student is introduced to the philosophy of science with special emphasis on the role of science, research methodology and integrity in scientific research. These activities are individually executed under the supervision of an advisor. Seminars are scheduled to promote interaction among the participants.

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INSTRUCTIONAL MATERIALS DEVELOPMENT

Elizabeth Kirby	MDR 8751204
Carolyn C. Weddle	FY87 $153,820
Georgia Department of Education	FY88 $201,954
Atlanta, GA	FY89 $585,340
	FY90 $ 57,810
	Broadcasting

"Demonstration Project - Model Plan for Video Utilization, Grades K-12"

Optimal use of video resources as an integral part of instruction in K-12 public schools has been hampered by the difficulty teachers experience in obtaining video materials that meet specific instructional meeds, and obtaining access to video equipment. A project conducted by the Georgia Department of Education in the late 1970's demonstrated that utilization of instructional television (ITV) materials increased if teachers were given input into the selection and scheduling of ITV programming. Since that time, the use of broadcast in Georgia as a means of resource distribution instead of resource scheduling has given teachers greater flexibility in the selection of instructional video resources. Two limiting factors remain: and inability on the part of the teachers to determine which video meets specific instructional needs and a lack of video equipment in the classroom. The Georgia Department of Education and the Clarke County School System will develop and implement a model project which demonstrates that optimal video utilization is achieved if teachers are provided: 1) easy access to video equipment in the classroom, 2) video materials that support their instructional needs, and 3) instruction in the use of video materials and the operation of video equipment. This project will equip each math and science classroom in Clarke County with a videocassette recorder and television monitor, provide each school with a collection of math and science video resources, and provide teachers with a comprehensive video index, and development in the utilization of video resources. The project will measure and compare level of video usage before and after classrooms are equipped with easily accessible equipment.

That quality video materials increase learning has been documented. The potential for improving teaching and learning through the use of new technologies has also been demonstrated. However, the demands of the classroom teachers tend to preclude their taking the steps now necessary to utilize the technologies. This project will provide a model as well as documentation that teachers want and will use improved methods of instruction if unreasonable demands are not made in order to use the methods.

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CAREER ACCESS OPPORTUNITIES

E.Jo Baker	USE 8850680
Georgia Tech Research Corporation - Georgia Inst of Technology	FY88 $80,869
	Other NEC
Atlanta, GA	

"Futurescape Expands"

This model project is designed to raise the aspirations and preparation levels of young women in the middle and junior high school grades, which represents a strategic point in the academic development of women, to increase their awareness of the wide range of science and technology related career opportunities open to them provided they prepare themselves academically. These objectives are being realized by putting these students in direct and continuing contact with role models, both college students and professionals. The schedule of project activities includes three one-day programs at Georgia Tech, two for public schools and one for private schools. Approximately 300 students and 30 sponsors (teachers, counselors, parents) attend each session. Twenty to thirty women in various science and technology related careers, together with twenty college science students, interact with each group of students. Graduate students or faculty will provide laboratory demonstrations involving science or engineering projects. A follow-up newsletter that will urge a response will be sent to each student in order that the impact of the program will be enhanced. The evaluation component of the project includes in depth surveys of students and counselors to determine changes in the types of curricula pursued, and changes in career plans as a result of participation. Future plans include the development of programs of longer duration in which young women would be in residence on the campus for several days. The network of presenters will be expanded to include faculty at neighboring institutions, such as the Communicable Disease Center.

COLLEGE SCIENCE INSTRUMENTATION

Robert A. Pierotti	USE 8750927
Georgia Institute of Technology	FY87 $50,000
Atlanta, GA	Chemistry

"Effective Utilization of Chemical Instrumentation in Undergraduate Instruction: A Regional Approach"

This project is continuing and expanding an effort, begun several years ago, to provide maintenance and repair service for chemical instrumentation at undergraduate institutions in the southeast. The service is provided by trained electronic personnel working from a mobile van outfitted as an electronics shop, and includes repair, maintenance, calibration, and consultative instruction among the offerings available. In the history of operation to date, 84 undergraduate institutions in Alabama, Florida, Georgia, North Carolina, South Carolina and Tennessee have been involved and over 3000 instruments have been serviced and calibrated. It is anticipated that 50 colleges and universities and over 5000 students will be affected each year by this project. Institutions served include a number of colleges for minorities and women.

YOUNG SCHOLARS

Donald G. Hicks	RCD 8850175
Georgia State University	FY88 $42,774
Atlanta, GA	FY89 $42,744
	Chemistry

"Chemistry Applied to Solving Problems in Modern Technological Societies"

Twenty high school students with limited chemistry background work for 8 weeks during the summer in the Chemistry Department of Georgia State University. Participants develop basic research skills and knowledge of chemical science as they work with practicing scientists in an intensive, hands-on, laboratory-oriented project. Students evaluate the fundamental character of their assigned mixed ligand solvent extraction reagents, and attempt to use the extraction reagents to find a solvent extraction system for separating and recovering a vital metal from a low-grade ore, scrap metal, industrial by-product, or waste effluent. The need to solve the practical laboratory problem provides the rationale for lecture-recitation topics. Personal contact with the participants is maintained about once a month during the following academic year. About 25 percent of the lecture time in the summer and academic year is devoted to career development and science ethics topics. In a second summer continuation project three-quarters of the first summer's participants return to work with their choice of a faculty research director.

FACULTY ENHANCEMENT

Curtis T. Sears, Jr.	USE 8854202
E.Kent Barefield	FY88 $153,272
Georgia State University	FY89 $156,584
Atlanta, GA	FY90 $159,844
	Chemistry

"Undergraduate Faculty Enhancement in Chemistry: A Series of Regional Workshops"

Georgia State University (GSU) and the Georgia Institute of Technology (GIT) will operate an Undergraduate Faculty Enhancement project in Chemistry for Georgia and surrounding Southeastern U.S. states. The project will improve the ability of faculty at two- and four-year, public and private, institutions to teach a modern program in Chemistry.

The major activities of the project are 15 one-week workshops and six 2-day mini-symposia. Workshop topics are: (1) molecular modeling; (2) mass spectrometry; (3) microcomputer-instrument interfacing; (4) FT NMR; (5) chromatography; (6) application of molecular orbital theory to organic and inorganic chemistry. Mini-symposia are mini-courses in: (1) organometallic chemistry and homogeneous catalysis; (2) solid state chemistry and superconductivity; (3) DNA chemistry and its application to biotechnology. The workshops and mini-symposia will be taught by GSU and GIT faculty. Additionally, prominent specialists from other institutions will serve as keynote speakers. Annual reunions of all participants during the preceding 12 months will also be held to exchange experiences in implementing new methods in the curriculum. Over a three-year period, 1710 participant-days are scheduled. A compilation of all innovations in the coursework at undergraduate colleges resulting from the project will be sent to all project participants. In addition to the NSF grant, participants' institutions will contribute about 5% in travel funds toward the operation of the project.

RESEARCH IN TEACHING AND LEARNING

Michael U. Smith	MDR 8609356
Mercer University	FY87 $65,465
Macon, GA	FY88 $63,677
	FY89 $70,170
	Biology

"Development of a Comprehensive Model of Problem Solving in Classical Genetics"

The purpose of this project is to extend an ongoing research program which seeks to understand the nature of problem solving in classical genetics. Previous research by the Principal Investigator has demonstrated numerous distinctions between successful and unsuccessful problem solvers on a variety of moderately difficult genetics problems. The proposed research will supplement and extend work with difficult genetics problems. It will also supplement and extend this data by analyzing the video taped interviews of a broad range of subjects as they attempt to solve "real-world" genetics problems such as those requiring the analysis of pedigrees or of non-idealized experimental data. The problem representation study of Chi, Feltovich, and Glaser (1981) will also be essentially replicated in an effort to obtain preliminary data regarding planning. During these studies and an additional longitudinal study of four subjects, special emphasis will be placed on identifying potential developmental patterns. Based on these findings, a computer program is to be generated which will model the genetics problem-solving performance of subjects from a variety of levels of expertise.

COLLEGE SCIENCE INSTRUMENTATION

Troy L. Story, Jr.	USE 8750001
Morehouse College	FY87 $45,648
Atlanta, GA	Chemistry

"Multi-Course Instrumentation Laboratory"

A multi-course instrumentation laboratory has been established in the Chemistry Department at Morehouse College. This laboratory includes equipment for the instrumental part of a traditional undergraduate chemistry laboratory together with a laser laboratory and a computer laboratory. Courses have been modified to include the use of computer-interfaced spectroscopic equipment with appropriate software for data analysis, laser-based experiments, and computer-based instruction devoted to solving chemical problems with the type of software found in modern academic and industrial settings. Majors in chemistry, biology, and physics, and students pursuing careers in the health and engineering professions are impacted by the activities of this facility. Since Morehouse is the only one of four colleges in the Atlanta University Center Consortium which offers all of the upper division courses required of chemistry and pre-engineering majors, these activities represent a unifying effort embracing students at four undergraduate institutions.

COLLEGE SCIENCE INSTRUMENTATION

Marion Furr	USE 8750881
Patrick Johnson	FY87 $29,604
Paine College	Biology
Augusta, GA	

"Computer-Controlled Instrumentation for the Improvement of Introductory Undergraduate Biology Laboratories"

Computer-based laboratory control centers (each including a Macintosh microcomputer, a high resolution pH meter, controlled-temperature water bath, programmable stirrer/hot plate, spectrophotometer, compound microscope, electronic balance, and centrifuge) are facilitating the development of computer, analytical, statistical, and observational skills for students enrolled in the introductory Principles of Biology course. Competencies are being developed through a series of Biology projects requiring skill in monitoring, data collection, statistical analysis, modeling, and report generation.

With this new academic thrust, even lower division students are becoming better prepared to undertake undergraduate laboratory research, to complete major field projects, and eventually to participate successfully in graduate, medical, dental, and other professional programs.

NETWORKS PROGRAM

Carolyn C. Chesnutt	TPE 8550247
Southeastern Consortium for Minorities in Engineering	FY85 $130,241
	FY86 $221,970
Atlanta, GA	FY87 $157,419
	Other NEC

"Exporting Success at the Grassroots Level - Elaboration and Expansion of the SECME Model Through Support of Local Beacon School Networks in the Secondary Schools"

The purpose of this project is to reach significantly larger numbers of students and school systems. SECME will develop and implement a "Beacon Schools" program that will strengthen existing SECME schools and introduce new schools to the program. The Beacon Schools will provide assistance to other SECME schools in their immediate area and to other major program activities and control to local sites through the designated Beacon Schools.

The Beacon Schools strategically located throughout the southeast will use a Master Teacher Network to accomplish its objectives. Through team building workshops, outreach programs, bimonthly support and coordination meetings, a monthly newsletter, and Master Teacher meetings, these Beacon Schools will provide continuous and coherent support to all schools in the program.

This project is timely and important since it will enable the already established SECME program to reach more disadvantaged students, especially in rural areas. As a result of this project, the pool of prepared students entering careers in engineering, mathematics, and science will be increased and the technological literacy of disadvantaged students in the southeast will be greatly enhanced.

COLLEGE SCIENCE INSTRUMENTATION

Preston A. White, III	USE 8851403
Southern College of Technology	FY88 $87,173
Marietta, GA	Electrical Eng

"Automated Antenna Analysis Laboratory"

This project exposes students to an Automated Antenna Analysis Laboratory (AAAL), a computer-driven test and measurement system equivalent to that used in the Communications industry. Students using the AAAL study in great detail the performance of virtually all types of antennas including satellite dishes, mobile antennas and complex arrays. Using the AAAL equipment, students verify the performance of their antenna designs while learning the characteristics of automated-test systems. This laboratory also serves as a regional resource to other Technical Institutions in the area.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Gladys S. Bayse	USE 8853335
Spelman College	FY88 $8,149
Atlanta, GA	Chemistry

"Instrumental Analysis and Data Analysis, an Honors Chemistry Course"

The project is providing instruments and microcomputers to support a senior-level Honors Chemistry course, Instrumental Methods and Data Analysis. The course is placing heavy emphasis on data acquisition and handling using computer-interfaced instruments and selected software packages on microcomputers. Students are then able to evaluate the reliability of collected data and subsequent calculations from their experimental results on several classical instrumentation projects. Undergraduate research efforts are also being enhanced by this project.

The grantee is matching the award from non-Federal sources.

COURSE AND CURRICULUM

Nagambal Shah	USE 8813792
Spelman College	FY88 $50,000
Atlanta, GA	Mathematics

"Calculus Planning Project"

The proposal is a planning project that will hold a series of seminars to focus on the special needs that women have in the study of calculus and mathematics. The culminating event will be a faculty retreat and the writing of a report on the faculty member's "shared experiences." The project will be at Spelman College, a traditional black institution for females with strong academic traditions. The program will include formal participation by the Chairman of the Mathematics Department at Agnes Scott College, a female institution with equally strong academic traditions.

The year will start with three seminars lead by consultants with special expertise in the area of female studies in mathematics. The consultants are: Elizabeth Fennema, Lenora Bloom and Rhonda Hughes. These presentations and consultations should sensitize the faculty participants to the special elements of females studying mathematics. Three additional consultants will assist with three later seminars that will concentrate on the role of computers in the study of calculus. In the spring term, a pilot section of calculus will use and investigate computer software specially designed to assist in the study of calculus. Three undergraduate students will help with the evaluation of the materials. The year will end with a two day retreat in which the senior personnel and a graduate student will concentrate on the successful experiences that the faculty members have had in their years of instructing female students. With the help of the specialized consultants, the faculty will be sensitive to the issues, able to recall and clarify their collected experiences and compile a report of "successful shared experiences."

RESEARCH IN TEACHING AND LEARNING

Leslie P. Steffe	MDR 8550463
University of Georgia	FY85 $152,912
Athens, GA	FY88 $ 18,905
	Mathematics

"Child Generated Multiplying and Dividing Algorithms: A Teaching Experiment"

Approximately 50 teaching episodes have been completed during the academic years 1985-86 and 1986-87 with each of six children who were nine years of age and in the third grade at the start of the teaching experiment. Each teaching episode was approximately 30 minutes in duration and was video-taped. This data is now serving for retrospective analyses of the construction of multiplying and dividing schemes by each child, including their concepts of multiplication and division.

The basic goal of the retrospective analyses is to formulate an itinerary of the step-by step construction of multiplying and dividing schemes by each child. The second goal is to interpret the communicative interaction between each child and the teacher (from the point of view of the teacher) and to formulate models of the evolving zones of potential development--that which the children can learn under the guidance of the teacher--for each child given their specific schemes. The third goal is to specify the problematic situations that were used in the teaching experiment from the point of view of both the involved child and the teacher and then to establish the contributions of these problematic situations to the constructive activity of the child. Finally, the fourth goal is to write a research book much like the two books "Children's Counting Types: Philosophy, Theory, and Application" and "Construction of Arithmetical Meanings and Strategies" that have been written as a result of past teaching episodes.

The FY88 award provides supplemental funds for completing the analyses and the research book.

TEACHER PREPARATION PROGRAM

Michael J. Padilla	TPE 8652036
University of Georgia	FY86 $459,700
Research Foundation	FY87 $286,484
Athens, GA	FY88 $284,141
	FY89 $ 96,647

"University of Georgia Middle Grades Teacher Education Project"

This project is developing a four-year model program for the preparation of middle school science and mathematics teachers. There will be new content courses in both science and mathematics, modification of many existing science and mathematics courses, and the development of innovative "parallel" methods courses for each content course. Numerous practicum and clinical field experiences will be provided through the program. Students will develop depth in mathematics and science as well as skills in teaching middle school children.

The proposed program represents a cooperative effort involving scientists, science educators, mathematicians, mathematics educators, teacher educators, and public school personnel.

The project also includes collaboration with two other teacher preparation programs in the State of Georgia. The program at Fort Valley State College serves a large minority community, and the program at North Georgia College serves principally a rural region.

INSTRUCTIONAL MATERIALS DEVELOPMENT

James W. Wilson	MDR 8651611
University of Georgia	FY86 $367,754
Research Foundation	FY87 $ 6,000
Athens, GA	FY88 $178,153
	Mathematics

"A Revision of the Geometry and Measurement Strands, K-6"

Geometry and measurement are closely related topics that are, in current elementary school curricula, usually taught in separate chapters. In reality, however, many measurements involve geometric entities. Similarly, many of the properties of geometric figures are derived through work with measurement. Thus it is reasonable that the geometry and measurement strands be considered together. This project will revise both strands, exploiting the natural connections between geometry and measurement to their mutual advantage.

The revisions will be based on theory, the results of previous research, and expert opinion as presented in the literature. The theories of the van Hieles will be a major basis for the revision of the geometry strand. The theory of Piaget will likewise form a basis for revision of the measurement strand.

Fourteen prototype units, seven in geometry and seven in measurement, will be developed. Calculators and computers will be used whenever appropriate: in problem situations, in demonstrations, in open investigations, in development and exploration of patterns, and (sometimes) in performing calculations. The goal is to move mathematics curricula from static and rote presentations toward dynamic and meaningful investigations.

HAWAII

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Lawrence S. Braden
Mathematics
Iolani School
Honolulu, HI

Jo Y. Kanehiro
Science
W R Farrington High School
Honolulu, HI

1988

Kathleen Goto
Science
Moanalua High School
Honolulu, HI

Carey S. Inouye
Mathematics
Iolani School
Honolulu, HI

COLLEGE SCIENCE INSTRUMENTATION

Joseph R. Mobley, Jr.	USE 8750868
Chaminade University of Honolulu	FY87 $5,650
Honolulu, HI	Social Science

"Behavioral Sciences Laboratory Instrumentation"

A Behavioral Sciences Laboratory is being established specifically dedicated to support of student research projects, including those required in research-related courses as well as those of individual students. The IBM AT computers, related hardware, and SPSS/PC Plus Statistics and Graphics software package is greatly enhancing the level and sophistication of student research projects assigned for all students in the Anthropology, Sociology, and Psychology research sequence. The students are gaining hands-on experience in creating, storing and manipulating their data files. They are doing basic to complex descriptive and inferential analyses and graphic presentations of their data. These research capabilities are greatly enhancing the existing curriculum by providing students with an up-to-date, technologically advanced learning experience in behavioral science research.

COLLEGE SCIENCE INSTRUMENTATION

Arthur L. Mori	USE 8750869
Chaminade University of Honolulu	FY87 $26,550
Honolulu, HI	Chemistry

"NMR in Undergraduate Chemistry Curriculum"

The recent acquisition of a nuclear magnetic resonance (NMR) spectrometer by the Physical Science Department of Chaminade University of Honolulu is improving the undergraduate laboratory and directed research experience of undergraduate students. Freshmen and sophomores use the NMR spectrometer under close supervision; juniors and seniors use it on a regular basis for laboratory work and directed research. Nine different chemistry courses are affected, ranging from the introduction of NMR theory in the general chemistry course to detailed study and experimentation and research in the advanced chemistry courses.

YOUNG SCHOLARS

Sylvia Yuen	RCD 8850078
Richard L. Barker	FY88 $62,014
James L. Brewbaker	FY89 $62,014
Robert M. Caldwell	Agriculture
James R. Carpenter	
University of Hawaii	
College of Tropical Culture	
Honolulu, HI	

"NSF Young Scholars Pacific Region Program"

The goal of the NSF Young Scholars Pacific Region Program (PRP) is to increase the knowledge of 25 high ability high school students in the careers, philosophy and ethics, and problem solving methodologies in the mathematical, physical, biological, engineering, and social sciences as they relate to agriculture. Participants consist of students entering grades 10, 11, or 12 in Hawaii, American Samoa, Guam, Micronesia, and the Commonwealth of the Northern Marianas.

A curriculum which emphasizes experimental learning and offers variety, independence, and guided discovery in knowledge building is provided to participants. The PRP includes both a 6-week summer residential program and follow-up activities. The summer program consists of four inter-related learning experiences - case studies, group experiences, field experiences, and independent projects. Students are housed in University of Hawaii dormitories. Follow up activities take the form of research projects under the guidance of a scientific advisor. These are presented at a PRP forum held during the academic year and show-cased in science fairs, symposia, publications, and other forums.

IDAHO

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Ahmad H. Dolkhani
Mathematics
Pocatello High School
Pocatello, ID

Frank Ireton
Science
Mountain Home AFB Junior High School
Mountain Home AFB, ID

1988

LaRon Smith
Mathematics
Twin Falls High School
Twin Falls, ID

Robert C. Frank
Science
Jefferson Junior High School
Caldwell, ID

COLLEGE SCIENCE INSTRUMENTATION

Richard J. Reimann USE 8851891
Boise State University FY88 $12,105
Boise, ID Physics

"High Resolution Gamma Spectroscopy and Spectrum Analyzer for Undergraduate Laboratories, Projects and Undergraduate Student Research"

The grantee will purchase a high-resolution gamma-ray spectroscopy system, and a fast Fourier transform spectrum analyzer. This equipment will be used to provide research opportunities for undergraduate Physics majors, and to improve instruction in a senior Physics laboratory course and a senior Computer Science course. Planned student projects include the identification of radioactive isotopes in environmental samples, and investigations of magnet flux properties in high-temperature superconductors.

The grantee will match the NSF award with an equal amount of funds from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Monte D. Wilson TPE 8751245
Boise State University FY88 $73,755
Boise, ID Geology

"Natural Science Field Studies for Elementary and Junior High Teachers"

The focus of this project is on field investigations in the natural sciences and the integration of various types of basic field data to better understand the natural environment. During a four-week summer session, elementary and junior high teachers will engage in field investigations supported by laboratory activities and lectures. These studies will be directed at the management issues of Idaho's public lands and will include many presentations and field investigations lead by scientists from both government agencies and private industry.

As a part of the summer class, the participants will make teaching collections and investigate various methods of presenting such science content in their classrooms. Follow-up activities during the next school year will emphasize incorporation of material from the project into science teaching. Each participant will prepare and pilot a teaching unit on a topic related to their summer experiences and later share it with their fellow teachers. In addition, the project director and master teachers will visit the classrooms of all participants, and the participants will exchange classroom visitations in order to improve their teaching methods.

COLLEGE SCIENCE INSTRUMENTATION

Francis A. Sharpton USE 8853288
Northwest Nazarene College FY88 $14,814
Nampa, ID Physics

"Laboratory Modernization of Undergraduate Experimental Physics Laboratories"

The grantee will purchase six high-speed oscilloscopes, a high-resolution gamma-ray spectroscopy system, and an X-ray spectroscopy system. This equipment will be used to improve instruction in both lower- and upper-division Physics laboratory courses. Courses affected include a microcomputer interfacing laboratory and a spectroscopy laboratory. In addition, the equipment will be used by upper-division Physics majors for required individual projects.

The grantee will match the NSF award with an equal amount of funds from non-Federal sources.

ILLINOIS

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

John Benson
Mathematics
Evanston Township High School
Evanston, IL

Ruth Rand
Science
The Latin School of Chicago
Chicago, IL

1988

Walter Dodge
Mathematics
New Trier High School
Winnetka, IL

Frank Cardulla
Science
Niles North High School
Skokie, IL

COLLEGE SCIENCE INSTRUMENTATION

Elizabeth R. Hayford	USE 8751460
Associated Colleges Midwest	FY87 $12,745
Chicago, IL	FY88 $ 608
	Mathematics

"A Conference on Undergraduate Mathematics Curricula and Instrumentation"

The Associated Colleges of the Midwest, in conjunction with the Great Lakes Colleges Association, sponsored a regional conference for mathematicians involved in the undergraduate mathematics curriculum from non-PhD granting institutions in the upper Middle West, in June 1987. The conference had two primary goals: (1) to provide a series of presentations analyzing the ways in which undergraduate mathematics courses can more fully integrate instrumentation; and (2) to inform participants who will develop laboratory-based mathematics courses about opportunities for assistance from the National Science Foundation's College Science Instrumentation Program. A paper on curricular changes integrating instrumentation into undergraduate mathematics courses resulted from the conference and is being distributed to participants and more widely around the country. The model of this regional meeting may be used by NSF for other regional meetings with similar goals.

COLLEGE SCIENCE INSTRUMENTATION

Peter J. Adragna	USE 8852996
Aurora University	FY88 $5,960
Aurora, IL	Biology

"Computerization of an Undergraduate Physiology Laboratory"

This project continues a curricular plan initiated to improve undergraduate learning in anatomy and physiology. The plan began with an institutional grant that provided computer software development to augment the anatomy-physiology lecture series. The Science Division developed a microcomputer laboratory with eight Apple 2E microcomputers, color monitors, disk drives and an Apple printer. A pilot study of computerized data acquisition in physiology laboratories proved to attract student interest. Further investigations and an actual on-campus Intelitool demonstration preceded the developmental work that led to this grant.

The primary objective of the current phase of the project is to interface computer technology with the biology laboratory by using the Intelitool computerized system and programmable calculators. The Intelitool system stimulates experimental inquiry and research by providing data acquisition and analysis using Cardiocomp, Physiogrip, Spirocomp, and Flexicomp packages. Creative laboratory experiments are designed to maximize critical thinking and analysis. Additional printers provide students with print-outs of graphs and data sheets. Programmed calculators enhance statistical analysis and increase time devoted to the interpretation of actual data. Besides improving the physiology curriculum, this project also is expected to encourage student interest in scientific research, increase the number of students going on to graduate work in science (including women and minorities), and expose science student teachers to modern computerized laboratory technology.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

D.Paul Mehta	USE 8853102
Bradley University	FY88 $23,573
Peoria, IL	Mechanical Eng

"Implementation of A Modern Data Acquisition System"

This project supports development of a microprocessor-based and computer-interfaced data acquisition system for the undergraduate Mechanical Engineering laboratory. In addition to data generated in the laboratory, the students will also have the capability to acquire real world data through remote sensing. Sensors are installed in the field for the measurement of temperatures, pressures, flows, volt- amperes, strains, and mechanical vibrations on a mechanical system. The signals from the sensors are transmitted to the data acquisition laboratory via telephone lines. This provides the students opportunities for "hands on" experience with telecommunications in the acquisition, storage, retrieval, and analysis of data. Implementation of the undergraduate instrumentation laboratory at this institution enables the faculty to respond to the revolutionary effects of digital technology in mechanical engineering education.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Iqbal Shareef	USE 8853061
Bradley University	FY88 $41,000
Peoria, IL	Materials Eng

"A Model Laboratory for Material Removal Processes"

This project permits undergraduate students to gain experience with a modern material-removal processes laboratory. The laboratory experiments include topics ranging from measurement of accuracy of a machined part to measurement of surface finish, cutting forces, tool wear-temperature/chatter. The techniques employed to measure these variables include: measurement of forces using active systems such as quartz dynamometers, measurement of temperature using thermocouples, and measurement of wear from acoustic signals. The major equipment supporting this lab includes: profilometer, peize-electric load cell, a CNC mill, a signal analyzer, an acoustic emission transducer and a data acquisition system.

This award is being matched by an equal sum from the grantee.

INFORMAL SCIENCE EDUCATION

Sanford Friedman	MDR 8751442
Chicago Zoological Society	FY88 $121,012
Brookfield, IL	Biology

"Bringing Biology to Life in a Zoo Setting"

The Brookfield Zoo, operated by the Chicago Zoological Society, will develop a participatory exhibition on avian anatomy, physiology, behavior and ecology, "Be a Bird", whose overall goal is to bring biology to life with participatory exhibits in a zoo setting. The Brookfield Zoo will design and construct a permanent exhibition that uses discovery learning concepts to improve visitor understanding of birds and to motivate visitors to observe avian behavior in their everyday lives. Accompanying evaluation activities will contribute to a better understanding of informal education methods in zoos.

COLLEGE SCIENCE INSTRUMENTATION

Harvey V. Davis	USE 8852558
Columbia College	FY88 $17,909
Chicago, IL	Biology

"Modernization of Undergraduate Biology Laboratory Programs for Communications Majors"

This institution specializes in training future communications professionals, among whom are significant proportion of minorities. The Science Department provides instruction in basic science which is integrated with the students' communications specialties through the preparation of reports such as videotapes or films on individual research projects.

One of the shortcomings of the students' training has been the lack of experience with modern instrumental techniques. The instruments purchased through this project have applications in all Biology laboratory courses, and are available for use in students' research projects. As a result of this improved science training, it is expected that graduates, in their future careers in communications, will be able to report more effectively to the public on matters of science and technology.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Zafra M. Lerman	USE 8750193
Columbia College	FY87 $20,653
Chicago, IL	Chemistry

"Instrumentation for Undergraduate Instruction in Chemistry for Science, Technology and Communications"

Modern instrumental techniques including ultraviolet-visible spectroscopy, infrared spectroscopy and gas chromatography are being used by the Chemistry Department at Columbia College for the undergraduate instruction of students majoring in the communications professions. The theme of science, technology, and communications provides a focus for instruction in basic science which is integrated with the students' communication specialties through the preparation of videotapes or films on individual research projects. A project objective is that students, in their future careers in communications, will be able to use their scientific training to report more effectively to the public on matters of science and technology.

TEACHER ENHANCEMENT PROGRAM

Catherine J. Cook	TPE 8751314
Claudette M. Rasmussen	FY88 $494,244
Corridor Partnership for Excellence in Education	Mathematics
Aurora, IL	

"Problem Solving and Critical Thinking in Mathematics: Professional Development for Elementary and Middle School Teachers"

This is a three-year project to provide 540 teachers and 180 administrators with educational experiences and guidance on how to improve the programs at their schools in the areas of critical thinking and mathematical problem solving. Each year there is an initial training session offered to the participants and this is followed throughout the year with teams of teachers, administrators, and the project staff working together to become more knowledgeable in and devise methods to enrich the problem solving aspects of the programs at the target schools.

The Corridor Partnership has effectively brought together members of the local business community, scientists from the regional research laboratories and professional organizations, and professional educators at all levels to provide support and guidance to this project as well as to other efforts of the Partnership. Among these efforts, for example, are programs that were conducted during the fall and winter of 1986 which served as pilot projects for the proposed efforts.

INFORMAL SCIENCE EDUCATION

William J. Cromie	MDR 8470551
Council For the Advancement of Science	FY85 $26,214
	FY86 $26,214
Oak Park, IL	FY87 $26,214
	Communication

"New Horizons-in-Science Briefings for Education of Journalists"

This project provides support for the annual science briefings for journalists titled "New Horizons in Science." At these meetings science journalists and researchers discuss new scientific discoveries which are likely to have an impact on society and which have not generally been reported by the press. Approximately 15 to 18 scientists discuss new developments in their fields and respond to questions from the media.

The meetings are designed by and for the working journalist to provide maximum formal and informal contact between scientists and journalists as a way to improve communication between scientists and non-scientists, to increase the knowledge of professional science journalists, and to increase the quality and amount of science reporting in the popular media. The meetings have proven very successful and invariably result in extensive coverage of new information in the print and electronic media.

COLLEGE SCIENCE INSTRUMENTATION

Lavoir Banks	USE 8852175
Elgin Community College	FY88 $39,964
Elgin, IL	Chemistry

"Equipment to Enhance the Undergraduate Chemistry Program at a Community College"

A gas chromatograph-mass spectrometer system(GC-MS), a Fourier transform-infrared spectrometer and two high performance liquid chromatographs are being acquired for the Science Resource Center to help strengthen the Chemistry laboratory program. Acquisition of these instruments is enabling students enrolled in an Associate in Applied Science in Chemical Technology degree program to have access to these instruments which are widely used in industry; allowing industrial technicians to upgrade their skills; and allowing chemistry and other science and engineering students to use state-of-the-art equipment to develop laboratory skills, as well as reinforce the learning of chemical principles. High school advanced placement students, students preparing to be teachers and precollege science teachers are also benefitting by having access to the instruments. In the program, laboratory experiments are being emphasized, utilizing the requested instruments which bridge theoretical concepts with practical industrial applications.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Marjorie G. Bardeen	TPE 8751431
Fermi National Accelerator Lab	FY88 $193,522
Batavia, IL	Physics

"Topics in Modern Physics: Curriculum Materials and Inservice Program"

Topics in Modern Physics: Curriculum Materials & Inservice Program is a two-year project of the Friends of FermiLab Association designed to update high school physics courses in Northeastern Illinois by augmenting the curriculum and improving instruction. A group of Fermilab scientists and four high school physics teachers will develop a teacher resource book on modern physics topics such as particle physics and cosmology. This group will then hold a three-week summer workshop for twenty master teachers which will include background lectures on modern physics and a laboratory where new classroom materials can be tested. A comprehensive physics inservice plan will be developed by the participants and implemented throughout the region in the following academic year.

INFORMAL SCIENCE EDUCATION

Michael Spock	MDR 8751766
Phyllis Rabineau	FY88 $717,242
Field Museum of Natural History	Geology
Chicago, IL	

"Science Components of a Major Exhibit on Pacific Islands"

The Field Museum of Natural History in Chicago, with partial support from NSF, will develop science, mathematics, and technology components for a new, permanent 17,000 square foot exhibition on the Pacific. Broad in scope and dramatic in its impact, this exhibition will cut across many fields and disciplines in presenting a coherent, integrated view of the Pacific regions. Topics from anthropology, geology, biology and geography will be combined using collections, reconstructed objects, large scale models, and interactive components in this landmark exhibition. The project will make extensive use of leading researchers, educators, and an evaluation consultant, and will utilize a variety of prototyping and formative exhibit development techniques. The science, mathematics and technology portion will cost $1.9 million, of which approximately one third is requested from NSF. The complete 17,000 square foot exhibition will cost $3.3 million and will be seen by at least 10 million adults and children over its 20 year life.

TEACHER ENHANCEMENT PROGRAM

Marjorie G. Bardeen	TPE 8850345
Friends of Fermilab Association	FY88 $204,044
Batavia, IL	FY90 $196,860
	HS Science/Math

"Summer Institute for Science and Mathematics Teachers at Fermilab"

Summer Institute For Science and Mathematics Teachers at Fermilab is a three-year project for 180 high school biology, chemistry, physics and mathematics teachers to enhance their professional competence. Morning sessions will include lectures to strengthen teachers' backgrounds and expose them to new ways of approaching topics in their current classes. During plenary sessions the staff will present special topics on current scientific and mathematics research and societal problems related to science and technology. Laboratories will be devoted to exploring current methods of computer applications in data processing. Four graduate credits will be awarded by Aurora University.

COLLEGE SCIENCE INSTRUMENTATION

James Burnett	USE 8852522
Illinois Eastern Cmty College	FY88 $8,070
Olney, IL	Biology

"Instructional Equipment to Support Undergraduate Field Studies in Aquatic Microbiology"

This aquatic microbiology project provides two-year college students with the opportunity, instruction, and equipment necessary to conduct quality field work. One of the great resources of Southern Illinois (and all of the Midwest) is the abundance of water. This project targets these resources by focusing student experiences on the microorganisms of aquatic ecosystems.

Initial work on this project began during the summer of 1987 with the addition of two new courses: Field Biology and Research in Biological Science. This curriculum addition, combined with new equipment purchases, represents the faculty's determination and commitment to link the classroom with the world of living organisms. To support this project the NSF award has financed the purchase of a quality microscope with phase contrast, epifluorescence and photomicrographic accessories, as well as a small utility boat with equipment for sampling lake and reservoir sediments. With these equipment additions, the aquatic microbiology students are being given an opportunity to combine the excitement and motivation of field work with experience in conducting sound scientific inquiry.

Students enrolled in these courses are largely those in the college's four-year transfer program who look forward to completing the baccalaureate in a science-related field. Through reports by these students often presented to local high school classes and to community adult groups, the project also contributes to better public understanding of science and to increased pre-college student interest in science careers.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Earl F. Zwicker TPE 8652460
Kenneth Schug FY87 $460,416
Illinois Institute of Technology Mathematics
Chicago, IL

"Science and Mathematics Initiative for Learning Enhancement (SMILE)"

A long range cooperative effort between the Illinois Institute of Technology (IIT), the Educational Service Region of Cook County (ESRCC) and the Chicago Public Schools (CPS), initiated in the summer of 1986 to meet the educational needs in mathematics and science identified by teachers and administrators at the Chicago Board of Education, will continue for three years. The key features of Science and Mathematics Initiative for Learning Enhancement (SMILE) are an emphasis on the phenomenological approach to the subject matter, a format in which teachers in grades 4-12 work together to develop and critique mini-teach presentations of specific topics, and the establishment of a permanent teacher based interactive network of 450 teachers to further program objectives.

In each of three summers 60 Chicago area teachers will take part in an intensive five-week summer program where participants are separated into two groups, either Biology+Chemistry or Mathematics+Physics. Each group is supervised by a senior IIT faculty member and two high school teachers who are members of the project staff. Activities include plenary lectures, shop and preparation sessions, computer awareness, cross disciplinary interactions and mini-teaching in three member teams reinforced by college faculty members. This project is designed to increase expertise and communication skills and improve attitudes to increase classroom effectiveness. During the academic year four courses will be conducted which parallel the staffing and structure of the summer program and have an increased enrollment up to 100 teachers. At the end of the three-year program it is anticipated that SMILE will have developed a cadre of master teachers who will play key roles in a teacher enhancement activity focussed on elementary science and mathematics.

The Illinois Institute of Technology has a long record of commitment to and successful implementation of programs for high school teachers. Dr.Earl Zwicker, Professor of Physics and Dr. Kenneth Schug, Professor of Chemistry and Department Chair, will direct the project. In addition Dr. Arthur Devito, Associate Professor of Mathematics at Loop College and Dr. Daniel Koblic, Associate Professor of Biology at IIT will be consultants for mini-teach presentations and develop and maintain teacher networks in their respective discipline areas. Four master high school teachers will coordinate the direction of day-to-day activities and serve as role models who understand the phenomenological approach: Steve McVeigh (Biology), Val Dyokas (Chemistry), Larry Freeman (Mathematics), Roy Coleman (Physics).

TEACHER ENHANCEMENT PROGRAM

Thomas C. Fitch TPE 8851127
Illinois State University FY88 $194,051
Normal, IL FY89 $199,420
FY90 $207,651
Other NEC

"A Project Honoring Outstanding Teachers of Science in Illinois"

Forty OUTSTANDING Elementary/Middle School teachers of science will be selected to participate in an honors program conducted over a three-year period on the campus of Illinois State University. This project will develop scientific leadership for the local, state, and national level. The participants will be: 1) honored for excellence in science teaching, 2) provided with renewal and updating in the latest scientific advances, 3) involved in analyzing science education, and 4) conducting in-service teacher workshops in science for less well-prepared peers throughout the State of Illinois. The project will include strands of computer application, teaching methodology, instructional materials development, involvement with industrial scientists, and leadership development in science. The focus of the program will be the scientific disciplines of biology, physics, chemistry, and earth science. There will be workshops devoted to the preparation of computer programs, demonstrations, laboratories, and other instructional materials designed by participants to aid other less well-prepared teachers in improving their science courses; these will be disseminated throughout the school districts of Illinois and beyond. This project will develop a strong network of leadership in science within the State of Illinois. This is a collaborative venture involving the National Science Foundation, the Illinois Science Teacher Association, Illinois State University, and school districts within the State of Illinois.

TEACHER PREPARATION PROGRAM

Alba G. Thompson TPE 8652037
Carol A. Thornton FY86 $146,476
Illinois State University FY87 $151,800
Normal, IL FY88 $132,078
FY89 $142,781
FY90 $156,251
Mathematics

"A Model Program for Preparing Middle School Mathematics Teachers"

Illinois State University is developing a five-year model program for the preparation of middle school mathematics teachers. The project involves a major reconceptualization based on the premise that learning mathematics is a constructive process requiring reflective activity facilitated through problem solving experiences. Three new mathematics courses are being developed, and four pedagogical courses are being modified.

The program is a cooperative effort involving mathematicians, mathematics educators, and teacher educators. Students will study mathematics content and teaching methodology, be involved in numerous practicum and clinical experiences, student teaching, and a well developed set of induction year activities. The program has a strong mathematics component including course work in probability and statistics, mathematical modeling, geometry, and concepts in calculus and abstract algebra. A critical issues seminar will address the participation of women and minorities in mathematics, math related careers, and other relevant issues. Graduates will develop depth in mathematics as well as sensitivity and skill in teaching middle school students.

RESEARCH IN TEACHING AND LEARNING

Patrick W. Thompson — MDR 8751381
Illinois State University — FY87 $87,675
Normal, IL — FY88 $12,825
Mathematics

"Cognitive Effects of Multiple Representations of Mathematical Concepts: An Exploratory Study"

Mathematics learning consists of more than simply memorizing rules and procedures. Unfortunately, much of the mathematics currently being learned is of this type. A consensus is emerging, however, that a necessary condition for students to understand important mathematical concepts is that they possess multiple representational systems for those concepts and be able to translate smoothly and efficiently among them.

This project will study how we can teach effectively for students' development of multiple representational systems and how such instruction affects their development of concepts and skills. Two computer programs will be designed for this project: one for decimal numeration and one for algebra. Both programs will present simultaneous, "linked" representational systems. Students will solve problems by acting directly upon one representational system with their actions being automatically reflected in the other. Operations on decimals numbers will be studied for five weeks with a class of seventh graders. Concepts of expression, identity, linear equation, and solving linear equations will be studied with pre-algebra eighth graders over a school year.

The basic research methodology will be that of the constructivist teaching experiment. Through carefully planned individual and small group interview protocols, a model (models) of student knowledge will be constructed which describes the relationship among the representations taught. Curriculum materials to facilitate mathematical understanding will also be developed.

COLLEGE SCIENCE INSTRUMENTATION

Billy W. Geer — USE 8750319
Christina M. Schimandle — FY87 $14,658
Knox College — Biology
Galesburg, IL

"Equipment for Undergraduate Biological Chemistry Laboratories for Teaching Gene Expression"

Although the curriculum currently offers lecture courses in Biochemistry, Molecular Genetics, and Cell Physiology, laboratory work is available only in Cell Physiology. Given the tremendous advances in research that are occurring in Biological Chemistry today, this situation leaves Biology and Chemistry majors relatively unprepared for advanced work (including undergraduate research projects) in these areas.

This project is remedying the situation by supplying equipment for a Gene Expression Laboratory course in the Biology Department, and for new laboratory exercises associated with the current Biochemistry course in the Chemistry Department. In the former course, students are learning methods for the study of proteins, RNA and DNA at the molecular level. In Biochemistry, a new series of experiments involving enzyme functions, lipid and carbohydrate analyses, and protein purification are being added to the lab. The collective experience of these courses are allowing students to more fully utilize their talents as they prepare for scientific careers.

COLLEGE SCIENCE INSTRUMENTATION

Robert G. Kooser — USE 8851423
Knox College — FY88 $25,042
Galesburg, IL — Chemistry

"Revision of Junior Year Physical Chemistry Laboratory"

The project is removing four perceived deficiencies in the Chemistry curriculum. The deficiencies are: 1) lack of student exposure to modern, computerized instrumentation; 2) lack of laboratory courses at an advanced level; 3) lack of any laboratory work in the important area of polymer chemistry; and 4) lack of modern instrumentation to maintain a vigorous undergraduate research program. The grant is allowing the purchase of modern computerized spectroscopic instruments, computers to control them, equipment to introduce polymer chemistry into the curriculum, and a rapid kinetics spectrometer. The instruments are being used to revamp entirely the first term of the junior-level Physical Chemistry laboratory that is taken by all chemistry majors. In addition, the second term of the physical chemistry sequence that features kinetics and spectroscopy is also being substantially changed in order to incorporate the new capabilities into the laboratory. A new course in the chemical applications of magnetic resonance is being added to the curriculum to give students laboratory experience at the advanced level.

The grantee is matching the award from non-Federal sources.

YOUNG SCHOLARS

Eric R. Hamilton RCD 8850291
Loyola University of Chicago FY88 $34,626
Chicago, IL FY89 $34,626
Mathematics

"NSF/Loyola University Young Scholars Project"

This Young Scholars Project involves an intensive six week summer commuter course and an academic year follow-up for sixteen minority students entering eleventh and twelfth grade. The Project is conducted primarily on the Lake Shore campus of Loyola University of Chicago, and focuses on mathematics and computer science. The summer phase involves five components: a computer science lecture and discussion course stressing mathematical investigation; related programming activity; a computer hardware design and circuitry course; a physics laboratory experience, in which students will construct PC- compatible microcomputers; and a series of career seminars involving facility visits hosted by area computer science and mathematics professionals.

The academic year follow-up involves a preparation course for college entrance examinations, continuation of the integrated mathematics and computer course, and career development activities. Students keep the computers they construct during the summer phase, and use them for programming activities during the academic year phase.

COLLEGE SCIENCE INSTRUMENTATION

Homer A. Smith, Jr. USE 8750853
Millikin University FY87 $16,489
Decatur, IL Chemistry

"Modern Instrumentation for Project-Based Undergraduate Chemistry Laboratories"

For the optimum operation of a new project-based sophomore-junior chemistry laboratory program at Milliken University, the recent acquisition of a diode-array spectrometer, a gas chromatograph with integrator, and two microcomputers provides students with the speed and versatility needed to make fast, accurate measurements and to process data efficiently. In these laboratory activities, which have been transformed into separate courses with an emphasis on experiments rather than exercises, the objective is for students to develop maximum independence so that the difficulty often encountered in making the transition into industrial careers or graduate training can be minimized.

TEACHER ENHANCEMENT PROGRAM

Frederick Flener TPE 8751800
Northeastern Illinois University FY88 $162,746
Chicago, IL Mathematics

"High School Mathematics Instructional Improvement by and for Teachers"

The main goal of the project is to have outstanding teachers lead seminars in a program designed to upgrade the mathematics competence of less well-prepared teachers. There are to be two seven-week workshops with 25 participants; each workshop will be lead by a master teacher with significant expertise in the topic of the seminar which he/she leads. The plan is to use these seven master secondary school teachers as the main instructional staff of the workshop. Each week a major topic in secondary school mathematics is addressed by one of the master teachers. Some curriculum materials are also prepared for use in the participants' classes. Current topics are discussed, such as problem solving activities, probability, statistics and data interpretation, use of computers in the mathematics classroom, and geometry. Also, the master teachers devote time demonstrating and discussing effective instructional techniques and classroom organization. The follow-up activities include classroom observations and interviews with participants, supervisors and students. The dissemination activities include distribution of curriculum materials developed at the workshop, a newsletter containing reports of classroom uses of materials and methods, and possible use of participants as mentors in future workshops.

YOUNG SCHOLARS

Herbert J. Stoltze RCD 8850184
Eugene W. McArdle FY88 $67,018
Northeastern Illinois University FY89 $67,018
Chicago, IL Environmental

"Young Scholars Program: Workshop in Environmental Analysis"

This Young Scholars Project sponsored by Northeastern Illinois University enables 24 students entering the eighth and ninth grades in Chicago public schools to participate in a four-week workshop in Environmental Analysis during the summer of 1988. The students engage in scientific research as a means of promoting their interest in careers in science. They are given experience with research methodology, analytical procedures, and with the ethics of scientific research. Using the topic of environmental analysis of ecosystems, and with assistance from science practitioners and career counselors, participants are exposed to the excitement of research and the career planning process. To insure continuity and the achievement of project objectives, follow-up sessions are scheduled throughout the academic year.

RESEARCH IN TEACHING AND LEARNING

Jon D. Miller	MDR 8550085
Northern Illinois University	FY86 $ 296,783
Public Opinion Laboratory	FY87 $ 544,532
Dekalb, IL	FY88 $1,851,972
	FY89 $ 253,000
	FY90 $ 260,000

"A Longitudinal Study of the Development of Adolescent and Young Adult Attitudes Toward and Knowledge About Science and Technology"

The middle-school and high-school years are a period of change and crystallization in terms of life goals, disciplinary and course preferences, and social and political attitudes. The literature provides a number of cross-sectional descriptions and models concerning cognitive and attitudinal development during adolescence and young adulthood, but there are no longitudinal data available to study these processes.

The proposed longitudinal study will examine the (1) development of interest in science and mathematics, (2) the growth of scientific literacy, (3) the development of attentiveness to science and technology issues, and (4) the attraction to careers in science and engineering among two national cohorts of adolescents and young adults. One cohort will begin with a national sample of 3,000 seventh graders and follow them through the 10th grade. The second cohort will begin with a national sample of 3,000 10th graders and follow them for the next four years through the first full year after high school. Data will be collected from students, teachers, counselors, principals, and parents.

A purposive sample of two or three school districts with exemplary elementary school science and mathematics education programs will be selected and comparable data will be collected in these districts.

The analysis will consist of a series of expanding multivariate developmental models that will seek to understand cognitive and attitudinal growth and change in the context of family, school, and peer influences. Each wave of data collection will provide an opportunity to examine cognitive and attitudinal change measures in an increasingly rich context of previous measures. Periodic reports will be issued with each cycle of data collection and the data will be made available to other scholars on a timely basis.

The first phase of the project, being funded at this time, provides approximately 15 months for instrument development and pilot testing, for sample selection, for monitor selection and training, and for working with the research advisory committee.

RESEARCH IN TEACHING AND LEARNING

Jon D. Miller	MDR 8807409
Northern Illinois University	FY88 $98,566
De Kalb, IL	Studies

"Public Attitudes Toward Science and Technology"

A national opinion survey will be performed to measure the attitudes of the U.S. adult public toward science and technology. Data will be collected by telephone in the spring of 1988 using a national multistage cluster sample of about 2000 respondents. Some questions will continue data series previously collected for the program, while others will update part of a major study conducted in 1957. Additional questions will assess the public's experience with computers and the use of information sources regarding public science and technology issues. Some questions will also be designed to correspond with those being used in national British and Japanese surveys that will be performed at about the same time. An integrated data set will be developed that will contain the whole data series, along with a code book, so that researchers in public attitudes can make use of this important resource.

The Science Indicators program has been collecting data in this area since 1972. They have been used mainly in the biennial series of Science and Engineering Indicators reports, though important research papers have also appeared. These materials have provided valuable insights into public thinking about science and technology issues, and thereby have helped inform discussions of such issues.

This project is co-funded with the NSF Division of Science Resource Studies.

TEACHER ENHANCEMENT PROGRAM

Jerry P. Becker	TPE 8651670
Southern Illinois University	FY87 $276,549
Caarbondale, IL	FY88 $150,784
	Mathematics

"Integrating Problem Solving Into Mathematics Teaching: A Model and Demonstration Project"

This two-year project for teacher development is offered at Southern Illinois University at Carbondale for the purpose of enhancing mathematics education in the southern half of the state of Illinois. Sixty teachers, elementary and secondary, broken into appropriate grade level groupings, will be given the opportunity to receive on-campus instruction in mathematics, problem-solving, the use of microcomputers in teaching, and to integrate the training received into classroom teaching. This project is based on a successful pilot program recently completed at SIU-Carbondale. In addition to the above objectives, a "community of scholars" will be created among these competent, enthusiastic teachers to continue the collegiality established and to maintain the impetus for improved mathematics education.

A four-week program is planned for the first summer, with a follow-up during the school year of twelve Saturday meetings, for the purposes of sharing experiences with each other and meeting with project staff and guest instructors of mathematics. Local school districts, the Renewal Institute for Practicing Teachers and the Education Service Centers are lending their support, financial as well as programmatic. This collaborative effort will result in teachers having the opportunity of earning sixteen credits from the University and benefiting from a good support system for the improvement of their classroom teaching.

This project offers a wide range of approaches aimed at the improvement of mathematics education throughout the K-12 grades through a collaborative project which involves important elements of the Southern Illinois educational community.

TEACHER ENHANCEMENT PROGRAM

Harold R. Hungerford	TPE 8652351
George H. Fraunfelter	FY87 $233.649
Southern Illinois University	FY88 $ 23.359
Carbondale, IL	Ecology

"The SIU-C - MSU Elementary-Middle School Issue Articulation Project"

This teacher enhancement project is designed to prepare 80 intermediate grade/middle school teachers, from schools in Illinois and Kentucky, to incorporate social issues in the teaching of science through a case study approach to ecological and geological phenomena. Middle school teachers from 40 school districts have already participated in the program and have begun to implement the case study approach to science in their classrooms. This project will extend the approach to intermediate grade teachers and provide time for articulation between the two levels of the school system. The proposal writers have definitively described the differences in approach to be used at each level and have well developed plans for articulation of the two approaches in the schools. Principals of the schools from which the teachers come will also be involved and there will be an outreach to involve the communities in which the schools are located.

The intermediate teachers will be involved in a four week summer program which will upgrade their knowledge of ecology and geology and introduce the case study approach to the study of social issues in these fields. Each will be required to develop an original case study to teach during the academic year. At the end of the workshop, the middle school teachers who have participated in the past two summers will join the intermediate teachers and work on articulation issues involved between the two levels. Extensive follow-up from college staff and a resource teacher, provided by the project, will assist in the academic year implementation of the project. A two-day conference will be held in the spring. Personnel from regional environmental/ecological organizations will serve as consultants to the teachers and staff.

The project staff is qualified to conduct the program, given its background in science as well as in the case study methods. Both institutions involved have a history of working closely with teachers in the region to foster and improve science education at the precollege level. Local school districts were involved in the planning of the proposal and are supportive of the activity.

The PI, Dr. Hungerford, has described the need for the supplementary FY88 funding as a process by which the articulated program of issue instruction (science/societal issues) will be enhanced and its erosion prevented. This extension will provide training to teachers from districts that have previously participated. In particular, those teachers who have been identified as successful facilitators will benefit from this additional training.

This supplementary funding will meet the expressed needs of current and former participants and of teachers in other districts now interested in issue instruction.

TEACHER ENHANCEMENT PROGRAM

Isaac L. Shechmeister	TPE 8751687
Walter Sundberg	FY88 $448,915
Southern Illinois University	Biology
Carbondale, IL	

"Research Experience for High School Master Biology Teachers"

This is a three-year project for 28 exemplary high school biology teachers from a region within a 200-mile radius of Southern Illinois University at Carbondale. It is designed to implement the following goals: (1) identify and recognize these teachers for inservice training in research methodology and application of the inquiry process to teaching high school biology; (2) improve the quality of education by enhancing the professional competence of biology teachers and to engage these teachers in all phases of laboratory research, allowing them to become more confident in practicing science and the inquiry approach; (3) offer these teachers pedagogical training in science teaching strategies to support the content in teaching high school biology; and (4) honor those teachers in a socially significant and tangible manner.

Fourteen professors of science with active research programs will serve as mentors and will work with two teachers each for the duration of the project. In this three-phase program, teachers will be given a thorough preparation and background for conducting their research, will actively work on their research project under the tutelage of their mentor, and will develop materials that will enable them to carry the results and the methodology of their research to their students. Rural clusters of experienced teachers will provide inservice education for their peers and the National Association of Biology Teachers (NABT) electronic bulletin board network will facilitate dissemination among the teachers and between the teachers and their University mentors. In addition, coursework of the participant's own choosing is offered tuition-free by the University.

YOUNG SCHOLARS

Teresa Trussell	RCD 8850320
Barbara Emil	FY88 $18,373
Southern Illinois University	FY89 $18,373
Carbondale, IL	Engineering

"Women's Introduction to Engineering Program"

Women's Introduction to Engineering (WIE) was initiated in 1981 to attract academically talented students to the field of engineering. The program is designed to provide a comprehensive exploration of career opportunities and a realistic introduction to engineering education before career decisions are made. Supporting objectives include: a) to introduce participants to the academic demands of college engineering study through direct experience; b) to assist students in planning preparatory coursework at the secondary level, increasing their chances of admission and retention in college engineering programs; c) to enhance career planning skills and promote consideration of non-traditional fields of study. The geographic target region includes the 32 southernmost counties in Illinois, a rural area with 112 secondary schools and a median enrollment of 300.

The summer program is a two-week residential session for 15 students on the Southern Illinois University Carbondale campus, complemented by a research presentation follow-up activity and a secondary educators' workshop.

TEACHER ENHANCEMENT PROGRAM

Emil F. Jason	TPE 8751757
Robert N. Pendergrass	FY88 $167,204
Paul H. Phillips	FY89 $169,300
Virginia B. Bryan	JHS Math/Science
Chung-Wu Ho	
Southern Illinois Univ - Edwardsville	
Edwardsville, IL	

"Improving Math and Science Instruction of Black Students in Junior High School"

This two-year project seeks to increase black students' interest and achievement in mathematics and science by improving the quality of the instruction that they receive in junior high school. The participants, who will be 52 underprepared teachers from the Saint Louis area, will deepen and broaden their knowledge of mathematics and science content, update their teaching skills, and become familiar with instructional uses of the computer in these disciplines. During the six-week summer workshops, the 24 science teachers will take courses in biology, physical science, and mathematics for science teachers, while the 28 mathematics teachers will take courses in mathematics topics and in microcomputers. Both groups will also discuss teaching methodology, as well as participate in a seminar on issues in minority education. During the academic year there will be monthly seminars for the participants, as well as classroom visitations by the project staff.

Visiting consultants, including black chemists and engineers, will enhance the participants' awareness of issues in minority education and assist the Principal Investigator in securing community and parental support for mathematics and science education. The evaluation will assess the project's effect on teaching strategies and on students' attitudes and achievement.

The project provides a model for other urban areas with large minority populations to follow in increasing the representation of blacks in mathematics and science.

The university's cost-sharing contribution amounts to 20% of the NSF award. The participants' schools will provide additional support for the project, including computers and instructional materials.

COLLEGE SCIENCE INSTRUMENTATION

Marilynn L. Livingston USE 8852165
Southern Illinois University FY88 $45,875
Edwardsville, IL Computer Science

"Parallel Computing in the Undergraduate Curriculum"

This project introduces undergraduate Computer Science students to parallel computing through coursework and laboratory experiences.

The laboratory consists of an Intel model D3-4 hypercube connected to the University's MicroVAX II systems over a local area network. The programming languages Fortran, C and LISP are available for parallel algorithm development.

Through the new course offerings in parallel computing, students study: parallel machine architectures, operating systems for parallel machines, languages and algorithms for parallelism. Through this project, students are given hands-on experience in an area that is gaining increasing importance in computing.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Robert N. Pendergrass TPE 8751439
Southern Illinois University FY88 $92,960
Edwardsville, IL Mathematics

"Discrete Mathematics, Probability and Statistics"

The proposed project intends to offer a six-week summer workshop for 28 high school mathematics teachers. The two major components of the workshop are courses in discrete mathematics and one in probability and statistics, each for four quarter hours of credit. In addition to these courses, there is to be a seminar devoted to sharing of ideas and the evaluation and development of resource materials for use in secondary school mathematics classes. Throughout the summer workshop and the academic year, microcomputers will be used as tools to teach mathematics as the teachers are encouraged to plan ways to use computers to make their teaching of these relatively new topics more effective.

During the academic year following the workshop, there will be monthly seminars for the participants. The project staff will visit each of the participants at their schools at least twice during the year; also, the staff will be available as consultants as needed by the participants throughout the year to facilitate their learning and application of the mathematical concepts of the two major courses.

The topics in discrete mathematics, especially elementary combinatorics, are important in the considerations of curricular revision at the secondary school level. Several recommendations to revise the mathematics curriculum have placed great emphasis on topics from discrete mathematics. These courses did not exist, for the most part, when the present crop of high school mathematics teachers were in their teacher preparation programs, and yet many of the topics in the courses are now to be included in the courses the teachers are expected to teach. It is essentially the education of the material as well as the adaptation of the concepts to the school program that is the thrust of this project.

COLLEGE SCIENCE INSTRUMENTATION

Marian Smith USE 8851589
Southern Illinois University FY88 $9,710
Edwardsville, IL Biology

"Modern Instrumentation for Teaching Undergraduates to Measure Photosynthesis"

This project is designed to broaden and strengthen the undergraduate program in Biology, with particular impact on departmental majors whose programs emphasize the subdisciplines of Botany or Ecology. The acquisition of a modern photosynthesis instrument system (portable infra-red gas analyzer which measures photosynthetic gas exchange and instantaneously computes photosynthetic rate, water-use-efficiency, intercellular CO2 concentration, and stomatal conductance) will allow the introduction into the curriculum of modern courses in Plant Physiology and Plant Physiological Ecology.

The photosynthesis system will be used by students in the laboratory and in the field to measure and evaluate the interrelationship between plants and the environment. This system is ideal for teaching undergraduate students about plant physiological processes because it allows them to collect and analyze real data, thus creating a favorable climate for learning the scientific methods that are critical to designing and conducting meaningful experiments. The system also will be used for science demonstrations in outreach programs for pre-college students, thus serving the additional goal of interesting uncommitted students.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Laura Bornholdt	TPE 8850710
University of Chicago	FY88 $7,680
Chicago, IL	Chemistry

"A Seminar for Chicago Public High School Teachers of Chemistry"

Sixteen teachers from Chicago, all inner city veterans who work primarily with minority students, will be selected to attend a four-week summer science seminar in chemistry. The seminar, to be held at the University of Chicago, includes a set of lectures and laboratory exercises with full regard to giving the participants material which can be immediately put to use in the laboratories of Chicago Public Schools. Laboratory experiences, chemical demonstrations, the use of computers in a chemistry lab, and the unique strategies required to teach chemistry effectively will be the foci of the seminar.

Eighty percent of the cost of the project is borne by private foundations and the University of Chicago.

Stuart A. Rice	USE 8652474
University of Chicago	FY87 $9,500
Chicago, IL	Studies

"Report of the Symposium on Undergraduate Education in Chemistry and Physics"

The results of a Symposium on Undergraduate Education in Chemistry and Physics, hosted by the University of Chicago in October 1985, have been published and disseminated. There were about 250 attendees at the symposium, generally from the Midwest, with some coming as far as from Wyoming. Dissemination of this report furthers the objectives of the National Science Foundation in disseminating information about the encouraging cooperative efforts in dealing with the needs of undergraduate education in sciences, engineering and mathematics. It complements the report of the NSB Task Committee on Undergraduate Science and Engineering Education (NSB 86-100) which deals with the same topic in all disciplines.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Paul J. Sally, Jr.	MDR 8550472
Sheila Sconiers	FY86 $204,494
University of Chicago	FY87 $181,415
Chicago, IL	FY88 $229,125
	Mathematics

"Materials and Teacher Development in Precollege Education"

The University of Chicago School Mathematics Project is in the process of developing and implementing in the classroom a comprehensive K-12 program designed to upgrade mathematics education for all elementary school students and for the majority of secondary school students who are in the middle achievement range. An up-to-date curriculum, emphasizing problem solving and applications, is being written and tested in Chicago area schools. In its elementary (K-6) component, the project seeks to reduce the amount of time devoted to teaching computational skills, introduce more geometry and statistics, and use calculator arithmetic to aid instruction and expand the teaching of applications of mathematics.

Initial funding for the project has been provided by the Amoco Foundation. Additional funding, to assist in supporting the secondary component, has been provided by the Carnegie Foundation. NSF funding will help support the elementary component.

The project will field test the elementary school mathematics materials that are being developed, including calculator workbooks, problem solving workbooks, and workcards designed to guide students in the independent use of a variety of manipulatives. It will develop a model for the teacher training necessary to assure successful use of the developed materials. The model will focus on training generalist teachers for grades K-3 and specialist teachers for grades 4-6. A teacher training package will be prepared for use by mathematics supervisors, coordinators, and others who wish to adopt the training program.

TEACHER ENHANCEMENT PROGRAM

Howard S. Goldberg	TPE 8751286
Philip Wagreich	FY87 $206,674
John F. Lussenhop	FY88 $226,221
Mark Smylie	FY89 $287,797
University of Illinois Chicago	Elem Science
Chicago, IL	

"A Model Integrated Mathematics/Science Teacher Enhancement Program to Improve Problem Solving and Quantitative Skills in the Elementary Schools"

The purpose of this project is to integrate mathematics, science, and computers, to enhance the mathematics and science content knowledge, problem solving skills, and analytical abilities of elementary school children. This will be accomplished by developing and implementing a model teacher and curriculum improvement program and by evaluation and dissemination of the model. The model program will involve 13 elementary schools in the Chicago metropolitan area. Two lead teachers from each school will participate in a series of Saturday seminars in 1988 and a summer workshop in 1989, both at University of Illinois at Chicago. The seminars will introduce the teachers to concepts in mathematics, physical science, and biological science, and teach them to communicate this information to their colleagues and to facilitate change at the school level. The curriculum that will be introduced through this program integrates mathematics and science, and focuses on the notion of a variable, particularly certain fundamental variables, such as length, area, volume, mass, and time, followed later by density, velocity, acceleration, etc. Emphasis is placed on teaching students the scientific method through hands-on experiments. An extensive and rigorous evaluation of this program will be carried out. A two-year implementation phase will begin in 1988 when the lead teachers will prepare monthly in-service lessons for their colleagues. Eventually over 340 teachers will be involved with the materials. The materials, curriculum, and techniques developed will be disseminated on a national basis through conferences and national summer institutes and publications.

NETWORKS PROGRAM

Philip Wagreich	TPE 8850359
Harvey B. Keynes	FY88 $163,375
University of Illinois Chicago	FY89 $135,992
Chicago, IL	FY90 $130,331
	Mathematics

"A Network to Increase the Involvement of Mathematicians in Pre-college Education"

The goal of this project is to develop a network to increase and facilitate the participation of mathematicians in programs for the improvement of pre-college education and expand communication between mathematicians and mathematics educators. Implementation of the network will take place in three stages. The first stage will consist of a workshop in the summer of 1988 to establish contacts between people who have been working in the field and those who are just beginning. The second stage will include the establishment of a network that will provide support for people in the process of developing new projects. Network activities will include consultation services, a project databank, a materials resource clearinghouse, the publication of workshop proceedings and a newsletter. Finally regional workshops building on the model of the first workshop will be held so that many more mathematicians will be reached.

APPLICATIONS OF ADVANCED TECHNOLOGY

Sharon Dugdale	MDR 8470608
University of Illinois at Urbana	FY85 $128,907
Urbana, IL	FY86 $138,003
	FY87 $150,140
	Mathematics

"Using Microcomputers in a Graphical, Functions-Oriented Approach to Topics in High School Algebra"

A set of microcomputer modules will be developed and field tested to examine the extent to which a heavily graphical, functions-oriented approach can render algebra more accessible and motivating to students. The activities will teach selected topics of algebra in a direct and highly intuitive manner. These materials will be in the same style as those developed in our previous projects, providing students carefully constructed environments which are direct expressions of the mathematics involved.

Functions and graphing are basic to scientific applications as well as to further work in pure mathematics, and they are areas where data indicate poor performance on the part of large numbers of students.

The materials will be designed so that they may be used as the basis for a course, integrated into an existing course, or used for individual study not related to a formal course. A modular structure will allow students to use individual activities to meet specific needs, whether they are meeting the concepts for the first time or reviewing previously-learned material.

COURSE AND CURRICULUM

Gerald J. Janusz	USE 8813873
Anthony L. Peressini	FY88 $40,785
University of Illinois at Urbana	Mathematics
Urbana, IL	

"Calculus Curriculum Development"

Mathematicians at the this university will investigate methods by which the teaching of calculus can me made more effective in conveying to students an understanding of calculus as a powerful problem solving tool. Course material planning will focus on the development of the problem sets that will lead students through the central ideas and methods of calculus and enhance their ability to read and write mathematics.

The project will consult with user departments in science, engineering and other areas; develop and class test course material for Calculus I based on an approach of Artin; focus on computational and problem solving; and develop student's capacity to read and write mathematics correctly and coherently.

A weekly Calculus Seminar will train teaching assistants and discuss content among faculty within and outside the Mathematics Department. In the Summer of 1989, a Calculus Workshop for UI faculty and high school teachers will be held.

The integration of computer technology with use of Mathematica software in the calculus curriculum will be supported by outside funds.

RESEARCH IN TEACHING AND LEARNING

Linda A. Meyer	MDR 8550320
Robert L. Linn	FY85 $84,968
University of Illinois at Urbana	FY86 $90,927
Urbana, IL	FY87 $91,000
	Studies

"A Longitudinal Study of the Acquisition of Science Concepts in Elementary School"

The proposed research has these objectives: 1) to track students' acquisition of scientific concepts from their home and school environments from kindergarten through fifth grade, 2) to assess students' knowledge and reasoning in several scientific subject areas, and 3) to analyze data from the home environment, textbooks, and classroom instruction in order to produce a causal model of how students acquire science concepts.

This study will run in tandem with a study funded by the Center for the Study of Reading on how students learn to comprehend science text. The work will be conducted with approximately 1,000 students form four school districts. Funding from the National Science Foundation will be used to: revise and administer parent questionnaires and student diary procedures; analyze science textbooks; observe science instruction; code student work; develop, pilot and administer new science measures; and analyze the data.

FACULTY ENHANCEMENT

Michael H. Pleck	USE 8854214
Thomas R. Woodley	FY88 $62,266
University of Illinois at Urbana	Engineering
Urbana, IL	

"Computer-Aided Engineering Design Graphics Instructional Approaches"

The project is a short course intended to immerse faculty in the methods and implications of teaching and applying engineering design graphics (EDG) with microcomputer-based graphics workstations and professional computer-aided design drafting (CADD) software. Participants will be guided through lesson plans, exercises, and computer-assisted grading strategies utilized in a highly successful and innovative instructional program for EDG instruction in the University of Illinois College of Engineering. The micro-CADD experience will include producing, modifying and interpreting graphic representations. It will also emphasize database implications of CADD and the use of CADD as an effective graphical interface to advanced systems for CAD, CAM, CAE, CIM, etc. This approach reflects the growing awareness that the effective application of CAD, etc. depends in large part on an individual's ability to visualize "objects" and to create and interpret them in graphic form. The course will include lecture-demonstrations in a specially equipped micro-CADD auditorium featuring a large-screen projection monitor. Individual laboratory assignments will take place on PC-based micro-CADD workstations, during which experienced graduate teaching assistants will assist the instructors in offering individual help and advice. The project directors will maintain personal contact with participants to foster success after the course.

In addition to NSF funds, participants' institutions will provide about 30% in travel costs toward the operation of the project.

TEACHER ENHANCEMENT PROGRAM

William F. Stout	TPE 8751729
Kenneth J. Travers	FY88 $156,012
University of Illinois at Urbana	FY89 $237,060
Urbana, IL	FY90 $234,717
	Mathematics

"University of Illinois Teacher Enhancement Project in Statistics Education"

By introducing teachers to an empirical approach to statistics, this three-year project will facilitate the teaching of statistics in middle and secondary schools. A total of 150 teachers of mathematics, science, and computer science will participate in a three-week summer workshop in statistics and in follow-up activities during the academic year. Evaluation will assess the project's success in introducing statistics into the curriculum at the classroom and the district level.

The project builds upon inservice workshops that were funded by the State of Illinois. Although based upon a high-school level statistics text (with accompanying software) that was written by the project directors, the workshops will familiarize participants with a variety of approaches to the teaching of statistics. There will be one workshop for 30 teachers in the first summer and two in each of the following two summers. Each of the five workshops will recruit from a particular region of the United States, and teachers will participate in teams of 2-4 superior teachers, depending on the size of the school. Each team will also include a supervisor or administrator, and must contain at least one senior teacher. The schools must agree to provide funds and other support for introducing statistics into the curriculum.

Cost-sharing contributed by the university, the participants' schools, and the publisher amounts to 32% of the NSF award.

STUDIES AND ANALYSES

Kenneth J. Travers OSPA 8751425
Ian D. Westbury FY87 $120,632
University of Illinois at Urbana FY88 $165,703
Urbana, IL Mathematics

"Second International Mathematics Study Data Base Enhancement Project"

This work by the University of Illinois is to maintain and enhance the data-base of the IEA Second International Mathematics Study (SIMS) for the next two years. SIMS was a comprehensive survey of the teaching and learning of mathematics in the secondary schools in 20 countries, including the U.S. Under this grant, the University of Illinois plans to enhance the utility of the data for research in a three- pronged effort, as follows: 1) place the data-base in "user friendly" formats and fully document it; 2) conduct training sessions on the use of the data-bases; and 3) convene a national invitational research conference to identify issues raised by SIMS that may lead to secondary analyses.

YOUNG SCHOLARS

John B. Beaver RCD 8755776
Kevin N. Finson FY88 $89,060
Western Illinois University JHS Science/Math
Macomb, IL

"Career-Awareness Experiences in Science and Mathematics for High-Ability Junior High Students"

This project is a cooperative effort between Western Illinois University (WIU); Educational Service Centers; regional business/ industry; and regional school districts. The project consists of a series of instructional and experiential activities conducted during a combination of two weeks on the WIU campus during the summer, internships with practitioners in the field, and a one-day fall semester session in November 1988. The major objective of the project is to introduce 24 high-ability 8th grade students from rural western Illinois to science and mathematics disciplines and careers. The instructional components include hands-on laboratory work related to a research area in each discipline, ethical and philosophical questions relevant to science research and technology, and information relating to career opportunities in science, technology, and mathematics. Project staff includes WIU faculty, with assistance from junior high school science teachers and representatives from business and industry.

COLLEGE SCIENCE INSTRUMENTATION

Harold B. Hart USE 8851438
Western Illinois University FY88 $13,254
Macomb, IL Physics

"Computerization of Introductory Physics Laboratories"

The grantee will purchase six air track systems, six photogate systems, six rotational dynamics systems, six measurement interfaces, and six microcomputers. This equipment will be used to improve instruction in Introductory Physics laboratory courses. Physics and pre-engineering students will receive a systematic introduction to the laboratory applications of microcomputers including data acquisition, instrument control, data analysis; and data display.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Janos Szamosi USE 8750029
Western Illinois University FY87 $22,268
Macomb, IL Chemistry

"Development of a Computational Chemistry Laboratory"

A computational chemistry course has been recently approved at Western Illinois University. To implement this curricular addition, 10 microcomputers with associated software are now available for student use in that course, and in addition are being used for data acquisition, storage, and analysis in other chemistry courses: instrumental analysis, physical chemistry, advanced inorganic chemistry, and junior and senior research projects. The major goal of this effort is to thoroughly integrate microcomputers into the chemistry curriculum.

INDIANA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Diane W. Burnett
Science
Warren Central High School
Indianapolis, IN

Allan R. Weinheimer
Mathematics
North Central High School
Indianapolis, IN

1988

Mary L. Derwent
Mathematics
St Joseph's High School
South Bend, IN

Gladysmae C. Good
Science
Arlington High School
Indianapolis, IN

INSTRUCTIONAL MATERIALS DEVELOPMENT

Edwin G. Cohen	MDR 8550902
Agency for Instructional Technology	FY86 $223,768
Bloomington, IN	FY87 $273,494
	Mathematics

"Mathematics for the '80's -- Math Six"

The Agency for Instructional Technology, in partnership with a consortium or more than 25 state education agencies, is in the process of developing Mathematics for the '80s, a collection of high-quality video and print materials that support mathematics teaching in grades 4-6. Materials for grades 4 and 5 have already been developed. This grant will provide partial support for the development of the grade 6 materials.

The project will develop a series of eighteen 15-minute instructional television programs, together with a teacher's guide that will include worksheets for students. The series will emphasize problem-solving and applications. Consortium agencies will distribute the materials within their states, via public and non-commercial cable television transmission, for example, and they may authorize off-air recording of the television programs and duplication of print materials for educational use within their legal jurisdictions. Nonconsortium agencies will be offered an opportunity to contract with the Agency for similar rights.

TEACHER ENHANCEMENT PROGRAM

Susan M. Johnson	TPE 8652001
Mildred T. Ballou	FY86 $107,223
Ball State University	FY87 $ 96,258
Muncie, IN	Elem Science

"Science for Every Elementary School Child: The Ball State University/Ft. Wayne Plan"

This project will develop and assess a model for increasing the quality and quantity of science taught by all elementary school teachers within a school district. Lead teachers will incorporate investigative science activities in their own classrooms; subsequently, they will work with the other teachers within their buildings and reach into all classrooms in the 36 elementary schools in the Fort Wayne community school system and in the Lutheran private school system. A team of 2 excellent teachers, one from grades K-3 and one from grades 4-5 will serve as catalysts for the improvement of science teaching within each school.

The project is based upon a needs assessment, pilot study, and recommendations from the science education literature. The model includes significant cost sharing and partnerships with the cooperating school district, the university, and local industry. The leadership team includes scientists, science educators, and school administrators. The model includes the development and support of plans and programs designed to sustain the results of this project well beyond the period of external funding from NSF. Plans are also underway for thorough documentation and dissemination of results. The project includes summer activities involving academic work in science and in curriculum development and a series of activities throughout the academic year that build upon the summer activities and will enable the teachers to assess the application of what has been learned in clinical practice. The model also includes special workshops conducted for administrators who work with the teachers in the schools. Staff members have expertise both in science and in science education and are very well qualified to conduct this project.

TEACHER ENHANCEMENT PROGRAM

Thomas R. Mertens	TPE 8751540
Jon R. Hendrix	FY88 $147,027
Ball State University	Biology
Muncie, IN	

"Enhancing a National Network by Developing Leadership Skills in Outstanding Biology Teachers for the Teaching of Human Genetics Knowledge and Bioethical Decision-Making"

This four-week project offered at Ball State University will give 40 outstanding biology teachers from throughout the nation the opportunity to update their knowledge of human genetics, bioethical decision-making skills, and teaching methodologies. They will thus be qualified to become part of the National Network to Implement Human Genetics and Bioethical Decision- Making in our Nation's Secondary Schools. With this project, this Network will be expanded to include members from the 20 states not currently represented, making it a nationwide entity.

The summer workshop will be followed by an academic year component designed to assist participants in achieving project goals.

YOUNG SCHOLARS

David R. Ober	RCD 8850150
Ball State University	FY88 $38,741
Muncie, IN	FY89 $38,741
	Electrical Eng

"An Introduction to Analog and Digital Electronics for Young Women and Young Men"

Ball State University offers two separate but identical two-week residential sessions on Introductory Electronics to 48 twelfth grade students. The first session will be for girls only; the second for boys only. These somewhat unorthodox girls-only/ boys-only programs provide educational opportunities for all interested applicants as well as offer an incentive to attract young women into a traditionally male dominated field.

Emphasis is placed on the application of electronics to science. Laboratory activities constitute approximately 50% of the program schedule. In addition, students construct their own computer interface. As a follow-up project, they use these interfaces to perform two experiments in their home school and send reports of their results to the project staff.

COLLEGE SCIENCE INSTRUMENTATION

Michael S. Maloney	USE 8750263
Butler University	FY87 $25,775
Indianapolis, IN	Biology

"Acquisition of Phase Contrast and Fluorescence Microscopes for Biology Education"

A comprehensive internal program review and the resulting curriculum review suggested that undergraduate majors in this Department needed more practical exposure to light microscopy and its attendant techniques. Through this project, the Department is purchasing sixteen student phase-contrast microscopes and three fluorescence microscopes for use primarily in the Cell Biology, Microbiology, Immunology and Invertebrate Biology laboratories. A TV camera, video recorder and TV monitor also are being used with one of the phase-contrast microscopes to enhance the study of living cells in introductory courses for majors and non-majors.

The use of living cells in portions of these courses, the new phase- contrast capability, and the means for showing preparations to the whole class, are adding significantly to the interest of students in these courses.

COLLEGE SCIENCE INSTRUMENTATION

David T. Harvey	USE 8750039
Depauw University	FY87 $21,995
Greencastle, IN	Chemistry

"Modernizing the Undergraduate Instrumental Analysis Laboratory"

Undergraduate chemistry majors at DePauw University are being provided with routine access to a significant number of modern instrumental techniques in the areas of spectroscopy, separations, and electrochemistry. A number of modern instruments have been recently acquired: cyclic voltammograph, gas chromatograph, atomic absorption spectrophotometer, ultraviolet-visible spectrophotometer, which coupled with existing departmental instrumentation, have allowed the development of a new laboratory curriculum in Instrumental Analysis. This course has an emphasis on methods for instrumental optimization, methods of data collection and analysis, and methods for studying chemical reactions and reaction mechanisms.

PRIVATE SECTOR PARTNERSHIPS

Margaret Buchanan	TPE 8851021
Eagle-Union Community School Corp	FY88 $139,913
Zionsville, IN	Computer Science

"Integrating Telecommunications into the Science Curriculum"

Six Indiana school districts, in partnership with industry, universities, libraries, data retrieval services, and a museum will develop and implement programs to give middle school students experience in computer data processing and literature searching. Through a summer workshop teachers from the school district will work with industry and university scientists to design scientific studies their students can pursue, both by data-generating experiments and by literature searching. Teachers, and in turn their students, will learn how to create data bases for their own results and how to access and search commercial data bases for complementary information. During the summer workshop the teachers will have an opportunity to test their programs on students in a museum prior to taking these programs back to their own classrooms. Materials and procedures developed during the project will be widely disseminated.

Cost sharing by the partners will total 17% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Gerald R. Bakker
Earlham College
Richmond, IN
USE 8750543
FY87 $7,800
Chemistry

"Undergraduate Instructional Use of a Diode Array UV/VIS Spectrophotometer"

The recent acquisition of a diode array ultraviolet-visible (UV/VIS) spectrophotometer, interfaced with a computer, is allowing undergraduate students in the Chemistry Department at Earlham College to develop a familiarity and competence with modern computer-controlled instrumentation. The system has the capability to collect data rapidly under a variety of circumstances and to manipulate and graph the data in various ways. Spectral analyses of metal complexes, chemical kinetics in biochemical systems, detector use in chromatographic separations, and use in independent study are among the applications of the system which students will explore.

COLLEGE SCIENCE INSTRUMENTATION

William H. Harvey
Earlham College
Richmond, IN
USE 8750217
FY87 $34,544
Biology

"Equipment to Expand Undergraduate Instruction in Cellular and Molecular Biology"

The Biology Department is involved in a four-phase program to expand the instrumentation of its Cellular and Molecular Biology laboratories. Phase one was completed by the institution; this project is covering the second phase which involves procurement of an ultracentrifuge, electrophoresis equipment, photographic equipment, a uv/visible spectrophotometer, a CO2 incubator, and an ion-free reagent water system. This equipment enables undergraduates to perform expanded laboratory experiments and individual projects in cell fractionation; protein, DNA and RNA separations; transfers of proteins and nucleic acids for testing and analysis (Southern, Northern, and Western blots); quantitative determination of proteins and nucleic acids; autoradiography; DNA sequencing; restriction digests of nucleic acids; and cloning of restriction fragments.

A new course in Molecular Genetics is being offered, while major laboratory segments of Advanced Cell Biology and Developmental Biology are being expanded. Substantial laboratory exercises also are being added to coursework in Microbiology, Genetics, Biochemistry, and Immunology. Students are gaining vastly expanded experience with current techniques and equipment used in Protein and Nucleic Acid Biochemistry and Molecular Genetics.

COLLEGE SCIENCE INSTRUMENTATION

Helen B. Hay
Earlham College
Richmond, IN
USE 8851514
FY88 $8,700
Geology

"Instrumentation for Undergraduate Projects in Seismology"

The grantee will purchase a 12-channel seismograph which will be used for student research on depth to bedrock under the surficial glacial deposits in Wayne County, Indiana. This will afford geology students the opportunity to learn shallow seismic reflection techniques while carrying out significant research projects. The equipment also will be used in a new course on geophysics.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

James S. Miller
Goshen College
Goshen, IN
USE 8750690
FY87 $16,108
Biology

"Equipment for Computer Interfacing in Undergraduate Physiology Laboratories"

New laboratory experiences for undergraduates in three Biology courses which have a substantial Physiology component (Human Anatomy and Physiology, Principles of Biology, and The Biological World) are being developed using new equipment acquired through this grant. The project has three major foci: teaching students how to interface computers with laboratory equipment, how to use computers to acquire data, and how to manipulate and analyze data with computer assistance. This equipment makes it possible to consider aspects of cardiovascular physiology, respiratory physiology, and the physiology of reflexes that previously could not be addressed in these courses because the requisite equipment was lacking.

Laboratory experiments in other areas also are being upgraded by involving students more directly. Laboratories being improved in this way include the EKG labs; lung physiology labs; exercise physiology labs; and labs in biochemistry and human genetics (where computer simulations are being used extensively). A laboratory manual is being prepared that reflects the hands-on experiences of this P.I. and his students.

TEACHER PREPARATION PROGRAM

John F. LeBlanc	TPE 8751478
Frank K. Lester, Jr.	FY87 $276,685
Indiana University	FY89 $290,000
Bloomington, IN	FY90 $300,000
	Mathematics

"Preparing Teachers to Teach Mathematics: A Problem-Solving Focus"

This 3-year teacher preparation project will develop and evaluate materials and strategies for preparing elementary school teachers in mathematics. As a joint effort of the Mathematics and Mathematics Education departments of Indiana University and the Dyer Elementary School of Monroe County, this project will interface with an overall revision of the University's elementary teacher education program. The new program will require that each student complete an 18-24 semester hour concentration (one choice is mathematics) and a three-semester sequence of school-based field experiences prior to student teaching. Specifically, this project will address the revision of two mathematics courses required of all preservice elementary teachers in order to upgrade and modernize the content and to integrate problem-solving emphases with computers and calculators. In addition two new courses for the mathematics specialists will be developed featuring instruction and internships in problem-solving approaches to the teaching of elementary school mathematics.

A vital feature of this model will be the development of a local elementary school faculty to offer an exemplary mathematics program. The in-service teachers of the Dyer Elementary School will cooperate in all phases of the field experiences of the preservice teachers. They will receive intensive but sustained assistance to improve their own teaching of mathematics to reflect the problem-solving goals and emphases of the teacher education program. They will develop their capacities to serve as significant teaching models and as clinical adjuncts to the campus-based components of the teacher preparation program. They will collaborate with project staff in the planning and evaluating of all phases of the school-based activities.

Project evaluation will include systematic formative and summative assessments of project strategies, accomplishments, and consequences. It is expected that university course materials, including print, video and computer/calculator components, will result. Further, plans for disseminating the model and materials throughout the Indiana University system, as well as nationally, have been made.

RESEARCH IN TEACHING AND LEARNING

Frank K. Lester, Jr.	MDR 8550346
Joe Garofalo	FY85 $69,455
Indiana University	FY87 $51,801
Bloomington, IN	Mathematics

"Role of Metacognition in Mathematical Problem Solving"

Among recent research on memory and cognitive development, there is a growing interest in phenomena referred to as metacognition. This basically consists of two components: cognitive self-awareness and behavior regulation. Such research has largely been the domain of developmental psychologists, reading specialists and special education researchers. Only recently have members of the mathematics education community become interested in the role of metacognition in mathematical performance. This study will investigate the metacognitive behavior of sixth grade students working on arithmetic computation and verbal problems.

The metacognitive behaviors will be examined through the use of paper-and-pencil tests, individual interviews and paired interviews. The investigation will also include an instructional treatment component designed to engage students in metacognitive activities during problem solving. The proposed study will:

1. design, collect and pilot-test suitable mathematics problems;
2. conduct clinical interviews, observe student problem solving;
3. develop and present instructional treatments;
4. analyze students' performance and report results.

The results of this investigation should give insights on how to incorporate a metacognitive dimension into problem solving instruction.

COLLEGE SCIENCE INSTRUMENTATION

Marshall P. Cady, Jr.	USE 8851189
Indiana University Southeast	FY88 $21,210
New Albany, IN	Computer Science

"A Computer Data Acquisition and Control Laboratory for Undergraduate Courses"

The data acquisition and control laboratory serves the needs of several courses. The laboratory will include analog and digital electronics, computers, computer interfacing devices and software. Topics taught in the laboratory include: a) hardware and software interfacing techniques, b) methods of computer based automation, measurement, data acquisition, experiment control, and data analysis.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Edward J. Kelly
Marion College
Marion, IN

USE 8750289
FY87 $9,180
Chemistry

"Integration of the Use of an NMR Spectrometer in an Undergraduate Chemistry Program"

Integration of nuclear magnetic resonance spectroscopy into the chemistry curriculum at Marian College provides students with an opportunity to put NMR principles into practice through "hands-on" experience, in class projects and in independent research. The use of NMR spectroscopy in Organic Chemistry, Organic Qualitative Analysis, Physical Chemistry, Instrumental Analysis and Independent Research complements student use of infrared and ultraviolet-visible spectroscopy, chromatographic techniques and electrochemical applications.

COLLEGE SCIENCE INSTRUMENTATION

Edward J. Kelly
Marian College
Indianapolis, IN

USE 8852225
FY88 $5,337
Chemistry

"Expansion of Electrochemistry in the Undergraduate Curriculum"

The undergraduate Chemistry program is being strengthened by the integration of the use of voltammetry and coulometry in the curriculum. Seven courses (Organic Chemistry, Qualitative Organic Analysis, Physical Chemistry Lab, Biochemistry, Quantitative Analysis, Instrumental Analysis and Independent Research) are being revised to provide students with the opportunity to put electrochemical principles into practice through "hands-on" experience, both in laboratory projects and in independent research. The use of voltammetry and coulometry is complementing the current Chemistry program in which students are using ultraviolet-visible and infrared spectrophotometers, NMR spectrometers, gas and liquid chromatography. Thus, integration of electrochemistry in the curriculum is assuring that students receive a more complete preparation in instrumental practice.

The grantee is matching the award from non-Federal sources.

COURSE AND CURRICULUM

Edward Dubinsky
Keith Schwingendorf
Purdue University
West Lafayette, IN

USE 8813996
FY88 $30,000
Mathematics

"Calculus, Concepts and Computers"

Three mathematicians within the Purdue University-Indiana University system will teach three small (25-30 students) prototype Calculus courses based on computer, computer languages and algebra systems.

The geometric and conceptual aspects of calculus, solution of applied problems, and reduction of routine drill by using symbolic manipulation will be emphasized. These courses will include both mainstream and non-mainstream calculus. The extent of the use of computer labs and the use of the ISTEL and Maple software packages will vary.

A consulting board of 25 experts from the various academic disciplines will suggest applications from science and mathematics from the latter third of the 20th century.

A unique component of this project will be research on how students come to understand or not to understand the underlying ideas in calculus. Theoretical analysis, observations and experiments on the teaching and learning of calculus will be formulated.

The grantee institution will share project costs.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Jane B. Kahle
Purdue University
West Lafayette, IN

MDR 8742342
FY86 $38,851
FY87 $87,600
FY88 $47,914
Other NEC

"Science Education for Rural Girls: Educational Equity Through Master Teaching"

This project builds upon recent work which identified instructional strategies and teaching behaviors which affect the retention of both boys and girls in science courses and careers. The primary purpose of this work is to develop an intervention program which will encourage more girls (as well as boys) to enroll in advanced science and mathematics courses and to promote their interest in scientific careers. To achieve that purpose, five groups will be involved in the intervention program: secondary school biology teachers, students, parents, community and industrial volunteers, and science education researchers.

The project will proceed through five stages. A preliminary study will determine the needs of rural biology students, the utility of various intervention materials, and the validity and reliability of selected assessment instruments. Rural biology teachers will be recruited to participate. Next, the selected intervention teachers will participate in a two-week, intensive workshop, conducted by master teachers, to develop a prototype intervention packet and to preview and evaluate commercially available materials. The fourth phase of the project will be actual implementation of the intervention programs in rural high schools. Finally, the evaluation phase of the project will assess the effectiveness of the program and develop an intervention packet suitable for wide and diverse dissemination.

TEACHER ENHANCEMENT PROGRAM

Gerald H. Krockover	TPE 8741434
David R. Smith	FY86 $137,497
Purdue University	FY87 $164,289
West Lafayette, IN	Atmospheric Science

"Atmospheric Science Education Program for Teachers (Grades 5-9)"

The Atmospheric Science Education Program for Teachers of Grades 5-9 is designed to improve the atmospheric science background of 24 Indiana teachers utilizing eight atmospheric science topics. Teachers will spend four weeks in residence at the Purdue University, West Lafayette campus.

Participants will spend a considerable amount of time in the field and will be furnished with a set of basic materials that they will keep and take back to their classrooms.

The project staff will conduct follow-up activities in the classroom for the purposes of providing expert resources to the participants and to assess the implementation of the atmospheric science topics into the curriculum. An extensive evaluation process will determine the impact of this project.

This project is funded jointly with the Directorate for Geosciences.

TEACHER ENHANCEMENT PROGRAM

Gerald H. Krockover	TPE 8751668
Purdue University	FY88 $241,140
West Lafayette, IN	Atmospheric Science

"Atmospheric Science Education Program for Teachers (Grades 7-12)"

Purdue University will provide over a period of two years the opportunity for 25 teachers per year, grades 7-12, to develop a strong foundation in the atmospheric sciences. The Atmospheric Science Education Program will consist of a three-week session during the summer, which will cover eight key atmospheric science topics, basic science of meteorology, school weather stations, weather analysis, forecasting, atmospheric moisture, motions, severe weather phenomena, and applications of atmospheric sciences to other disciplines. Teachers will be assisted in applying this science content through the development of materials for use in their classrooms. Equipment will be constructed and provided for home school use. Field experience will occupy the participants for one to one and one-half hours each day at the Cherry Lane Field Observing Facility.

A school outreach program will be conducted during the school year where project staff will visit classrooms and provide opportunities for follow-up meetings. Individualized consultations will be provided to help teachers adapt the materials and strategies to their own teaching styles.

Teacher and student interest in the atmospheric sciences will be heightened by the establishment of a dial-up, computer-based weather data access and electronic bulletin board system. This will be contributed by Purdue University. Also contributed by the University will be 8-10 videotapes about the professional activities of atmospheric scientists and related technological fields. Both of these vehicles will enhance the career access information available to students.

Cost-sharing by the University and the school districts, who are being asked to support their teacher-participants, amounts to 20% of the total cost of the project.

COURSE AND CURRICULUM

Robert G. Squires	USE 8854614
Gintaras V. Reklaitis	FY88 $89,594
P. K. Andersen	FY89 $93,487
Purdue University	FY90 $85,969
West Lafayette, IN	Chemical Eng

"Industry Participation in Chemical Engineering Laboratory Module Development"

This project offers a novel approach to the design of experiments for the senior Chemical Engineering laboratory by combining computer simulation, the cooperation of industrial sponsors, and a videotaped facilities tour. The resulting laboratory experience is challenging, interesting and educationally effective. An ideal laboratory experiment would duplicate an industrial project, using modern equipment to investigate a complex problem under realistic time and budget constraints. As an affordable alternative to constructing and operating industrial-scale pilot plants, computer simulation and videotapes are combined in instructional modules. The project includes seven modules covering areas such as reactor design, separations, heat transfer, biochemical processing, and semiconductor processing.

Institutional support for this project is more than three-fourths of the amount of funds requested from NSF.

This project co-funded with the NSF Directorate for Engineering.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Grayson H. Wheatley	
Paul Cobb	MDR 8470400
Purdue University	FY85 $381,707
West Lafayette, IN	FY87 $ 52,705
	Mathematics

"The Development of Primary Level Mathematics Curricula Emphasizing Child-Generated Thinking Strategies and Algorithms"

This project will develop prototypical first and second grade instructional materials in arithmetic based on recent and continuing research on early number learning, children's self-generated thinking strategies, children's self generated algorithms for finding sums and differences, and children's beliefs about mathematics. The project will include a research component that will lead to the refinement and extension of models of children's self-generated strategies and algorithms. The research will build on previous work by the principal investigators and by others. The resulting instructional materials will be designed to encourage children to develop their own algorithms and to allow teachers to use this cognitive approach. The project includes plans for the field-testing and national dissemination of the prototypical materials.

COLLEGE SCIENCE INSTRUMENTATION

Richard L. Gonzales	USE 8750330
Purdue University Calumet Campus	FY87 $47,970
Hammond, IN	Electrical Eng

"A Microcomputer Applications Course and Laboratory for All Undergraduate Engineers"

This project will develop a sophomore course and associated laboratory required for all engineering students at Purdue-Calumet. It will teach them the fundamentals of embedded microcontrollers using the Embedded Systems Minion Teach module. The goal of the course and the significant laboratory component is to bring to students, who have an introductory knowledge of electric circuits and high-level language programming, a broad knowledge of the design of turn-key, embedded microcomputer controllers.

COLLEGE SCIENCE INSTRUMENTATION

Scott F. Argast	USE 8750250
Purdue University Fort Wayne	FY87 $45,175
Fort Wayne, IN	Geology

"Acquisition of an X-ray Diffractometer for the Undergraduate Geology Curriculum"

The University will introduce x-ray diffraction techniques into the undergraduate geology curriculum. X-ray diffraction is an essential tool for understanding crystal structures and mineralogy. The equipment consists of a Phillips X-ray diffraction system with scintillation detector and powder camera, sample preparation equipment, and microprocessor control. The equipment will find use in introductory mineralogy and petrology courses, advanced optical mineralogy and petrography courses, a techniques oriented course in x-ray mineralogy and as part of independent undergraduate research. With the availability of an x-ray diffractometer, students will gain a greater appreciation of the fundamental principles of crystallography and mineralogy and be better able to function as working geologists following graduation.

COLLEGE SCIENCE INSTRUMENTATION

Richard S. Manalis	USE 8852393
Purdue University Fort Wayne	FY88 $28,701
Fort Wayne, IN	Biology

"Computer-Mediated Undergraduate Laboratories for Animal Physiology and Neurobiology"

Physiology work stations which consist of modern data-taking equipment and Macintosh computers (which are well-known for their user-friendliness) are significantly improving the teaching of undergraduate students in this department.

Microcomputers used as scientific instruments in undergraduate teaching laboratories are perceived as being user-unfriendly by most students. This problem has been greatly reduced by the recent introduction of MACLAB by World Precision Instruments. MACLAB converts a Macintosh computer into a digital oscilloscope or chart recorder. One of the work stations in this project has a Macintosh II computer which functions not only as a digital recorder but also as a file server to the other computers in the network.

This allows physiology teachers to be innovative. For example, they are able to display previously recorded experiments in class. Students can take physiology laboratory examinations ("lab practicals") using MACLAB. The high gain preamplifier (model 6132) manufactured by Palmer Bioscience is a versatile instrument which functions as an interface between a physiological transducer or a membrane potential measuring circuit and the MACLAB.

The work stations are used by students enrolled in Introductory Biology, Animal Physiology, Neurobiology, and undergraduate research. All major pieces of equipment are commercially available, thereby facilitating the incorporation of similar work stations into biology departments at other institutions. The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Ronald S. Artigue USE 8750150
Rose-Hulman Institute of Technology FY87 $9,687
Terre Haute, IN Chemical Eng

"Introduction of Biotechnology into the Undergraduate Chemical Engineering Curriculum"

This project will assist the institution in introducing biotechnology into the chemical engineering curriculum. A bench-scale fermentor and ancillary equipment will be coupled to a microcomputer-controlled data acquisition system. This will result in a system that permits students to learn about the special conditions and problems associated with fermentation, an industrially important biotechnology process. The computer controlled data acquisition system will provide flexibility in experimentation, enhance data reduction and analysis, and expose the students to modern instrumentation.

COLLEGE SCIENCE INSTRUMENTATION

Ronald S. Artigue USE 8851780
Rose-Hulman Institute of Technology FY88 $24,718
Terre Haute, IN Chemical Eng

"Integration of Bioseparations into the Chemical Engineering Curriculum"

The purpose of this project is to establish laboratory instruction in bioseparations within the chemical engineering undergraduate curriculum.

The laboratory includes bench-scale bioseparation and supporting equipment, including a microcomputer-based data acquisition and control system. This collection of equipment permits students to apply their theoretical knowledge of bioseparation techniques and integrated downstream processing through laboratory experimentation, exposes them to analytical methods and techniques in biochemistry, automates the control and data acquisition of the experiments and familiarizes students with modern computer control and data logging equipment and techniques.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Jerry A. Caskey USE 8851502
Rose-Hulman Institute of Technology FY88 $17,934
Terre Haute, IN Chemical Eng

"Polymer Engineering Laboratory Improvement Program"

This project introduces a state-of-the-art laboratory experience to students whose concentration is in Polymer Engineering. The laboratory equipment (Differential Scanning Calorimeter/Thermogravimetric Analyzer), permits students to study and analyze polymer products that have recently been developed.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Barry J. Farbrother USE 8851364
Rose-Hulman Institute of Technology FY88 $85,000
Terre Haute, IN Computer Science

"Development of a Flexible Microcomputer Laboratory for Teaching Digital Electronics and Microcomputers"

This project enhances Computer and Electrical Engineering courses at this institution. Modular microcomputer systems and associated development hardware provide a high degree of configuration flexibility for use in both electrical engineering and computer engineering. The support equipment for this project includes personal computers that are utilized for digital logic design capability using programmable logic devices, for digital simulation, for software development and in-circuit-emulation. Using this lab, students experience the complete (hardware and software) design cycle from conception through design refinement and debugging, to the realization of a functional stand-alone embedded computer system.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Frank A. Guthrie USE 8750501
Rose-Hulman Institute of Technology FY87 $9,300
Terre Haute, IN Chemistry

"Undergraduate Laboratory Instruction in Electrochemistry"

A microprocessor-controlled electrochemical system has been recently acquired by the Chemistry Department of Rose-Hulman Institute of Technology.

allowing the use of this instrumentation for a number of applications in analytical, inorganic, and organic chemistry. These include a convenient and logical examination of electrode processes via the oxidation of various organic molecules in the cyclic voltammetry mode, enhanced ability to determine trace levels of ions via stripping and square wave techniques, and the availability of a new and powerful way to introduce students to free radical organic chemistry. Undergraduate students in analytical chemistry compare various analysis methods, and investigate indicator blockage by transition metal cations in EDTA titrations, whereas undergraduates in inorganic courses study catalytically active substances and carry out small-scale electrochemical syntheses.

COLLEGE SCIENCE INSTRUMENTATION

Robert J. Lopez USE 8851339
Rose-Hulman Institute of Technology FY88 $100,000
Terre Haute, IN Mathematics

"A Symbolic, Numerical and Graphical Computations Lab to Support a Revised Curriculum in Calculus and Differential Equations"

The Department of Mathematics at this engineering institution will establish for all freshman and sophomores a laboratory for symbolic, numerical and graphical computations.

SUN work stations and the computer algebra system MACSYMA will be the basis for radical change in the mode and methodology of the calculus and differential calculus sequences. The emphasis is to impact the engineering curriculum by stressing "mathematical experimentation" by use of powerful research tools used in industry.

The grantee is providing an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Noel E. Moore USE 8851814
Rose-Hulman Institute of Technology FY88 $12,805
Terre Haute, IN Chemical Eng

"A Multipurpose Process Control Experiment Using Self-Tuning Controllers"

This project introduces undergraduate Chemical Engineering students to a multi-purpose process control environment. Modern process control hardware and supporting equipment (including a microcomputer-based data acquisition and control system) significantly improves the undergraduate laboratory experience by: allowing students to compare conventional control strategies (single analog loops) with examples of modern computer control; exposing students to modern process control hardware (self-tuning controllers) and permitting them to compare equipment provided by several vendors; and acquainting students with state-of-the-art computer control and data logging equipment and techniques.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Alan T. Roper USE 8851543
Rose-Hulman Institute of Technology FY88 $41,500
Terre Haute, IN Mechanical Eng

"Aeronautical Instruction Laboratory"

This project enhances the aeronautical instructional capability at this institution. Students are exposed to the phenomena associated with aeronautical design and analysis through experiments using a highly instrumented wind tunnel. The wind tunnel is sufficiently large to produce flow conditions that allow wings which utilize modern airfoil sections (e.g., NASA General Aviation section) to behave properly and instrumentation of the wind tunnel that causes minimal interference with flow over the models. Students in the aeronautical option who utilize this lab are prepared for industrial careers in the field of Aeronautical Engineering.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Leland K. Shirely USE 8750480
Rose-Hulman Institute of Technology FY87 $50,000
Terre Haute, IN Mechanical Eng

"New Instrumentation and Equipment to Extend Instructional Capabilities in Undergraduate Mechanical Engineering at Rose-Hulman"

The project has two major goals, to make experimentation an integral part of a large set of courses in the Mechanical Engineering curriculum which have traditionally relied on the strictly lecture/recitation type of presentation; and to provide students with an exposure to complicated instrumentation systems which contain essential features of systems currently used in non-academic environments.

The project relies heavily on three general purpose data acquisition modules and one special purpose signal processor - an FFT analyzer. Two complex Mechanical Engineering systems, a laboratory model of a steam turbine and a full scale numerically controlled milling machine, will support the goals of the project. Finally a set of state-of-the-art flowmeters will extend the Department's inventory of scientific instrumentation.

COLLEGE SCIENCE INSTRUMENTATION

Arthur B. Western — USE 8851289
Rose-Hulman Institute of Technology — FY88 $41,788
Terre Haute, IN — Physics

"Modern Optical Instrumentation and Holography Laboratories for a New Undergraduate Program in Applied Optics"

The Physics Department will purchase optics equipment for six new undergraduate laboratories established to support a newly instituted Bachelors Degree in Applied Optics. Particular emphasis is placed on laboratories for Optical Instrumentation and Holography.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Nancy P. Nekvasil — USE 8851769
St Mary's College — FY88 $10,230
Notre Dame, IN — Biology

"Equipment to Improve an Undergraduate Physiology Laboratory"

The project goal is to upgrade the quality of the undergraduate Physiology laboratory by purchasing four 4-channel datagraph recorders which have the capacity to measure many of the important physiological parameters that are emphasized in the physiology courses. Previously only some of these phenomena were included in laboratory exercises due to equipment limitations. The scope of the laboratory portion of the physiology courses (which have served approximately 340 women students in the past five years) is being greatly enhanced.

The data graphs are being used, for example, to demonstrate blood pressure regulation, cardiac alterations in response to varying stimuli, and variations observable on the electrocardiogram when the subject is at rest or exercising. Previously there was no true exercise component to the lab experiments, not even in the areas of cardiovascular or respiratory physiology. The addition of these instruments to the laboratory permits the development of two important new exercises.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Pamela L. Plouhar — USE 8750481
St Mary's College — FY87 $27,380
Notre Dame, IN — Chemistry

"Development of the Undergraduate Biochemistry Laboratory"

The Department of Chemistry and Physics at St. Mary's College is upgrading the biochemistry offerings in the curriculum. A major thrust is the development of a biochemistry laboratory which emphasizes both the basic concepts presented in the associated lectures, and introduces the student to the techniques commonly used in the discipline. The recent acquisition of a high speed centrifuge, two ultraviolet-visible (UV/VIS) spectrophotometers, electrophoretic equipment, a tissue homogenizer, and an oxygen electrode has allowed the laboratory content to be significantly upgraded. Innovative laboratory courses which provide exposure to a number of fundamental biochemical techniques are now available, affording students better opportunities to apply their knowledge of chemistry to biological systems.

COLLEGE SCIENCE INSTRUMENTATION

David M. Sever — USE 8750005
St Mary's College — FY87 $49,825
Notre Dame, IN — Biology

"Electron Microscopy in the Undergraduate Biology Curriculum"

This project provides an Hitachi Model H-300 Transmission Electron Microscope with a Scanning attachment and the ancillary preparative equipment needed to install a new electron microscopy facility in space provided through new construction. The curricular improvements that result have been based on an extensive review of facilities, equipment and curriculum that firmly established the need for an electron microscope to make possible more sophisticated student work in both introductory and advanced courses -- including Biology and Human Values, Concepts of Biology, Plant Morphology, Anatomy of Vascular Plants, Parasitology, Physiology, Introduction to Research, and Independent Research Topics. The instrument's contribution to enhancing options for independent projects and required student research is of special significance. The departmental faculty is unusual in that five of its eight full-time members have had previous experience working with electron microscopy.

COLLEGE SCIENCE INSTRUMENTATION

Stanley L. Burden
Taylor University
Upland, IN

USE 8750172
FY87 $22,195
Chemistry

"High Performance Liquid Chromatography/Ion Exchange Chromatography at Taylor University"

High performance liquid chromatography/ion chromatography instrumentation is being used in laboratory activities in organic chemistry, analytical chemistry, biochemistry, environmental chemistry, advanced laboratory and student directed research in the Chemistry Department at Taylor University. Concepts currently taught are reinforced by these experiences and the range and sophistication of applications is enhanced.

COLLEGE SCIENCE INSTRUMENTATION

Timothy C. Diller
Taylor University
Upland, IN

USE 8750513
FY87 $30,476
Computer Science

"An Undergraduate Artificial Intelligence Teaching Laboratory"

This project is enhancing the artificial intelligence (AI) program at Taylor University in two ways. It is providing sufficient IBM PC/AT computing resources to support the teaching of Lisp, processing text, developing image processing programs and the teaching of expert systems. It is also making possible, through the acquisition of a TI Business Pro computer, student learning of speech processing. The package is allowing instruction, demonstration, research and experimentation in four AI courses, involving natural languages, image processing and expert systems. Students are developing and executing algorithms which understand speech, identify speakers and languages, and enhance the intelligibility of speech, as well as those which compress and generate speech.

COLLEGE SCIENCE INSTRUMENTATION

Philip M. Gerhart
University of Evansville
Evansville, IN

USE 8851517
FY88 $30,932
Mechanical Eng

"Student Designed Projects in Measurements and Instrumentation"

This project supports an innovative curriculum improvement in this institution's undergraduate Mechanical Engineering program. With the equipment funded by this award, students are able to design their own experiments in mechanical measurements and instrumentation, incorporating computer data acquisition and analysis as part of the laboratory experience. The equipment included in the measurements laboratory includes: analog/digital conversion system, data acquisition system, oscilloscopes, flow measurement system, temperature and humidity measurement system, linear displacement system,velocity and acceleration measurement system, rotational, load and torque measurement system.

This award is being matched by an equal sum from the grantee.

FACULTY ENHANCEMENT

John J. Uhran, Jr.
Eugene W. Henry
University of Notre Dame
Notre Dame, IN

USE 8854181
FY88 $73,027
Electrical Eng

"A Faculty Workshop on PC-Controlled Undergraduate Laboratory Experiments"

This workshop consists of two ten-day sessions for about 16 participants. It will introduce teachers of undergraduate electrical engineering laboratories to the computerized workstation concept. Using current technology in instrumentation, hardware and software, the workshop will explore the full range of capabilities that are now available for academic laboratories at reasonable cost. A strong emphasis will be put on creativity in designing laboratories, and on encouraging the participants to be creative in turn.

To achieve these objectives, the workshop will provide a balanced mix of theory, discussion and design in a laboratory environment. The laboratory facilities will be available around the clock. A maximum amount of sharing among the participants will be encouraged through open discussion periods, and a commitment to integrate new ideas into the curriculum of the home institution is expected.

In addition to the NSF funds, participants' institutions will contribute about 15% in travel costs toward the cost of the project.

COLLEGE SCIENCE INSTRUMENTATION

Bruce J. Hrivnak USE 8750722
Valparaiso University FY87 $22,395
Valparaiso, IN Astronomy

"Instrumentation for Astronomical Photoelectric Photometry"

Valparaiso University will purchase a 16-inch telescope made by DFM Engineering, along with a photoelectric photometer, spectrograph, and microcomputer for data acquisition and reduction. A dome and pier are presently available. The telescope will be used by undergraduate students for viewing and for research projects. Particularly, they will undertake a program of photoelectric photometry of short-period eclipsing binary stars. The students will plan an observing program, obtain measurements of the light variation of the two stars in their orbital cycle, reduce the data to a standard form, and analyze the light curve to obtain orbital and physical properties of the stars. This program will give the students excellent experience in all of the phases of a research project. The results can be presented in scientific meetings and published.

COLLEGE SCIENCE INSTRUMENTATION

Joel P. Lehmann USE 8852197
Valparaiso University FY88 $20,696
Valparaiso, IN Mathematics

"Integration of Mathematical Software into Calculus Courses"

Faculty will establish a microcomputer laboratory to support the calculus sequence. Numerical, symbolic and graphing capabilities of computers will be used to change the instructional emphasis in Calculus to an expanded coverage of concepts.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Gilbert M. Lehmann USE 8851636
Valparaiso University FY88 $8,860
Valparaiso, IN Mechanical Eng

"Data Acquisition System for Mechanical Engineering Laboratories"

This project incorporates data acquisition systems (DAS) into this institution's Mechanical Engineering laboratory. The DAS systems, consisting of four individual workstations, are interfaced to already existing laboratory equipment. Each workstation consists of a personal computer, data acquisition interface, printer, plotter and related software. This equipment assists students with data acquisition, computational analysis, and presentation of results for a variety of laboratory experiments. Students are freed from tedious manual data collection and analysis and focus their energies on the interpretation of results and parameter variations and responses. Students are actively involved in the setup of experiments, the interfacing of transducers, the use of off-the-shelf software, and the development of software for data presentation and analysis.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Gerald R. Seeley USE 8750643
Valparaiso University FY87 $27,100
Valparaiso, IN Civil Eng

"A Universal Testing Machine for an Undergraduate Civil Engineering and Materials Engineering Laboratory"

A modern, computer-controlled universal testing machine is being introduced into the undergraduate civil engineering and materials engineering laboratory. By using the computer-controlled machine, the student is able to run many similar experiments, thus demonstrating the randomness of data and the requirement for statistical analysis. Computer analysis is also allowing the student to observe and produce many different types of data. All of the activities are being done during the laboratory period and thus more tests can be conducted if necessary.

COLLEGE SCIENCE INSTRUMENTATION

Merlyn C. Vocke USE 8851690
Valparaiso University FY88 $44,386
Valparaiso, IN Electrical Eng

"An Integrated Design, Fabrication, and Radiofrequency Testing Laboratory"

This project exposes undergraduate students to a laboratory environment where the design, fabrication, and testing of circuits and systems for radiofrequency and microwave applications are linked together.

Students using the laboratory incorporate laboratory experiences into their design process; they gain a realistic view of the value and limitations of analytic models and the methods used to develop the models; they become familiar with industry practices and standards; and they experience the limitations of instruments and measurement techniques.

This award is being matched by an equal sum from the grantee.

IOWA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

David G. Griffin
Mathematics
Bettendorf Middle School
Bettendorf, IA

Sandra J. Walton
Science
Dubuque Senior High School
Dubuque, IA

1988

Pauline Antons
Science
Midland Community
Wyoming, IA

Morgan Masters
Science
Chariton Community Schools
Chariton, IA

COLLEGE SCIENCE INSTRUMENTATION

Stanley R. Watkins
Coe College
Cedar Rapids, IA

USE 8750159
FY87 $9,111
Chemistry

"Computer Interfaced UV/Visible Spectrophotometry for the Chemistry Undergraduate"

The versatile instructional experiences which modern, computer- interfaced spectrophotometers make possible are now available to undergraduate students in chemistry at Coe College. A photodiode ultraviolet-visible spectrophotometer has been recently acquired, which when suitably configured with a personal computer, affords students opportunities to perform experiments utilizing the latest advances in spectrophotometry. The capacity to recall archived data and use third party software to design spreadsheets for performing calculations and plotting spectral data is of pedagogic value in advanced courses that include the study of kinetics, coordination compounds, and the quantitative analysis of complex mixtures.

COLLEGE SCIENCE INSTRUMENTATION

Ann Blakley
Cornell College
Mount Vernon, IA

USE 8750306
FY87 $7,767
Biology

"Scientific Equipment for Undergraduate Instruction in Animal Physiology and Behavior"

In the area of Animal Physiology, fundamental research tools are a computer-recorder system and a storage oscilloscope for monitoring physiological functions and changes. In Animal Behavior and Ornithology a storage oscilloscope has become the standard tool for displaying and analyzing an array of animal vocalizations. In both areas there are many experiments that help to elucidate important concepts that cannot be done without these instruments. The purchases made possible through this grant are enlarging this Department's capacity to train undergraduates in these areas.

The importance of these additions stems from the fact that, over recent years, research in Physiology and Animal Behavior has become increasingly dependent on high-technology equipment. As usage of this type of equipment has become a matter of course in research laboratories, it has become essential for instructional purposes as well. Students must be introduced to equipment that is used routinely to gather data if they are to become familiar with and eventually to evaluate concepts developed as a result of that experimentation. Likewise, their potential as research scientists is enhanced by a working familiarity with the methodologies that are used widely in current research.

COLLEGE SCIENCE INSTRUMENTATION

James Freeman
Cornell College
Mount Vernon, IA

USE 8852519
FY88 $67,745
Computer Science

"Integrating Graphics Workstation Technology into the Computer Science Curriculum"

This project supports curriculum improvements in Computer Science at this institution. Using graphics-based, windowed workstations that are networked, existing courses have been modified and a new course in Computer Graphics introduced. The equipment supporting this project includes: Apollo DN3000 and DN4000 workstations; DEC, Apple and Tektronix printers; and software including UNIX, Modula2, Lisp, and C. In addition to programming skills, students are exposed to software development, network management and graphic tools.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Robert C. Larson USE 8852339
Drake University FY88 $29.150
Des Moines, IA Chemistry

"Introduction of a Computer-Controlled Gas Chromatograph / Mass Spectrometer into an Updated Undergraduate Chemistry Program"

Principles and applications of gas chromatography/mass spectrometry is being introduced into the Chemistry curriculum as one phase of improving chemical education. Through the purchase of a bench top GC/MS complete with computer operating system and software the students are being given the opportunity to gain hands on experience with this powerful modern analytical technique. The instrumentation is being introduced in analytical and advanced opportunities sequence and carries over into organic, inorganic, physical and biochemistry courses.

The project is fostering within the undergraduates the familiarity, knowledge, and expertise in modern chemical instrumentation required for successful undergraduate research, careers in industry or entry into professional and graduate schools. Through an advanced opportunity program, students are being exposed to the major areas of chemical instrumentation in their freshman and sophomore years. Analytical instrumentation, presently fragmented throughout the curriculum, is being brought together in a unified junior level advanced analytical course. A new emphasis is being brought to undergraduate research within the department.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Richard Biagioni USE 8750712
Grinnell College FY87 $23,987
Grinnell, IA Chemistry

"Fourier Transform Infrared Spectrophotometer System"

A Fourier Transform infrared (FTIR) spectrophotometer system, with moderately high resolution and sufficient computer power to allow sophisticated data analysis, has recently been acquired by the Chemistry Department of Grinnell College. A spectral data base and an attenuated total reflectance sampling accessory are integral parts of the system. A major impact of this acquisition is in the Instrumental Analysis course where extensive data manipulation, database searching, quantitative analysis and low light techniques will be a major emphasis. In addition, the system is used in other upper division courses, particularly in the ongoing active student research program, and in the Physical Chemistry laboratory for obtaining and analyzing high resolution spectra of gases.

COLLEGE SCIENCE INSTRUMENTATION

Lenore T. Durkee USE 8851261
Grinnell College FY88 $49.844
Grinnell, IA Biology

"Scanning Electron Microscopy for Undergraduate Student Research and Instruction in Biology"

This project provides a scanning electron microscope (SEM) to supplement the school's existing microscope facilities. The unique imaging capabilities of such an instrument provide information which cannot be supplied by either light microscopy or by a transmission election microscope.

With this new instrument, the department can (1) modify the existing electron microscopy course to include all phases of specimen preparation and operation of the SEM so that students may use these techniques where appropriate in independent study and research, (2) help students become discriminating judges of the increasing amount of SEM evidence now presented in the literature of various disciplines, (3) utilize SEM in such courses as Principles of Biology, Cell Biology, Microbiology, and Systematics, in which scanning images serve as particularly useful instructional devices, and (4) make available and encourage the use of the instrument by students in other departments who require the kind of information that it can provide.

In the curriculum, this new machine is being used to demonstrate relationships between structure and function at a number of biological levels. Basic biological concepts (not just techniques) are being taught.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Eugene A. Herman USE 8750715
Grinnell College FY87 $50,000
Grinnell, IA Mathematics

"Using Powerful Computer Software in a Laboratory Environment to Help Undergraduate Students Develop Mathematical Insight"

The mathematics department at Grinnell College will develop a Mathematics and Computing Lab in which students use software packages that strengthen mathematical intuition and insight by representing mathematical ideas and objects (such as functions, matrices, differential equations, infinite series, computer programs, and algorithms) in a variety of forms that permit them to be manipulated and experimented with. The objective is to promote the kind of direct acquaintance with and understanding of these mathematical objects that professional applied mathematicians and computer scientists have traditionally acquired through long experience or unusual insight, and have more recently begun to develop more quickly through software tools. Specifically, the software will include packages for graphical display and manipulation of functions and algorithms, numerical approximation, and symbolic algebra.

The computer system used will consist of a Sun 3/160S file server, a large disk and tape system, and eight Sun 3/50M workstations. The workstations in the lab will be connected to a departmental local area network, which will give faculty and students equal access to all resources and enable them to exchange information from the lab, faculty offices, and classrooms.

COLLEGE SCIENCE INSTRUMENTATION

Kathryn Kamp
Grinnell College
Grinnell, IA

USE 8851417
FY88 $7.662
Anthropology

"Computerization of Archaeological Mapping in Field School and Field Methods Classes"

An electronic theodolite coupled to an electronic distance meter, a small hand-held computer and a field printer, subsequently interfaced with the field laboratory microcomputer, enhance the ability of students to participate in the analysis of data in an archaeological field school context. The same equipment, by increasing the efficiency of data collection, allows on campus students in an Archaeological Field Methods class to map data for the more satisfactory completion of research projects.

The award will be matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

George Magrane
Dean Hartman
Iowa Academy of Science
Cedar Falls, IA

TPE 8751770
FY88 $150.022
FY89 $157.489
FY90 $162.168
Mid Sch Science

"Iowa Middle School Science Project"

The Iowa Middle School Science Project is a cooperative project involving the fifteen Iowa Area Education agencies and faculty members from Cornell College, Coe College, the University of Iowa, and the University of Northern Iowa.

Ninety teachers (thirty each year from at least three different grade levels) representing the school districts of the fifteen Area Educational Agencies (AEA) will participate in a six-week summer institute held at Coe College in Cedar Rapids. During the academic year, regional AEA sites will host at least two, 2-day follow-up meetings to support the participants.

Each of the three years basically duplicates the first year with one additional feature. Participants from the preceding year will return for one week to extend their work and to interact with the incoming participants.

Science concepts from physics, chemistry, earth science, and biology will be presented. The pedagogical components include an emphasis on the Learning Cycle Model as well as including misconception research and Cooperative Learning approaches into teaching science.

The participants will form a Science Cadre which will design and arrange workshops for the non-participating teachers in each of the Area Education Agencies. Local District Inservice Programs will be held 4-5 times in each of the 15 agencies. The district inservice activities will be conducted by the project staff and capable AEA Cadre members.

All participants will participate in the Project Bulletin Board, which is the proposed state node for the National Computer Network for Science Education currently being funded by the National Science Foundation (NSF).

The projects allowed a large number of teachers to be involved in a state-wide inservice program. It demonstrates that a cooperative endeavor across district lines is a viable approach to developing programs.

The Area Education Agencies and the State of Iowa Department of Education have contributed an amount equal to 34% of the NSF award.

FACULTY ENHANCEMENT

T. A. Austin
K. M. Waggoner
Kenneth A. Brewer
Robert Hollinger
Don Polden
Iowa State Univ of Science & Tech
Ames, IA

USE 8722200
FY88 $45.710
FY89 $45.710
Civil Eng

"A New Methodology for Teaching Engineering Ethics"

Undergraduate engineering curricula in the U.S. require issues of engineering ethics to be addressed. Engineers and the engineering profession recognize that students need to learn how to use and assess available information in making ethical decisions, and how to test and develop their own perspectives on professional ethics. They need to develop the thought processes necessary to integrate information with acceptable professional "norms" of behavior. Yet, surveys demonstrate little in the way of formal or systematic approaches to the development and testing of new curricula or teaching methods. This project will develop an interactive computer simulation to assist in teaching undergraduate engineering students to develop critical thinking skills and apply them to the consideration of ethical, legal and social aspects of engineering decisions. The goal is to develop a tool that can serve to supplement and extend traditional teaching in engineering ethics. This initial phase of the project will develop and test an expert system simulation of one to five scenarios. Several expert system shells will be evaluated for this purpose. Data bases for the simulation will be designed to incorporate data from all branches of engineering and all states; but the initial model will use data collected only from Iowa and from Civil Engineering. The computer data bank will contain information from professional societies and advice from colleagues and attorneys, and from other sources, which students must evaluate to arrive at their final decisions. The approach should provide students with simulated real world experiences and expose them to the complexities and uncertainties in resolving problems in engineering ethics.

This project addresses an important issue in a unique way. The research team is interdisciplinary and well qualified to collaborate in the development of the "engineering ethics tutorial." Collaboration and further effort are likely to continue beyond the duration of this award. The project is designed well; appropriate testing and dissemination are planned.

RESEARCH IN TEACHING AND LEARNING

Camilla P. Benbow	MDR 8651737
Iowa State University of Science	FY86 $182,199
and Technology	FY87 $181,145
Ames, IA	Studies

"A Longitudinal Study of the Educational Patterns of High Achievers in the Sciences"

The Johns Hopkins Study of Mathematically Precocious Youth (SMPY) has identified roughly 10,000 preadolescent boys and girls (mostly 7th-graders) who reason exceptionally well mathematically, and have an exceptional potential for high achievement in mathematics and sciences. Since its initiation in 1971, the study has conducted a wide range of tutoring, counseling and other activities that help students to realize this potential.

In the current research, factors associated with becoming high academic achievers by the end of college will be identified. SMPY has extensive questionnaires completed by these students at age 12, when they had just entered college, and (in progress) a year past expected college graduation. The study will document the educational, familial background, and personality characteristics of these mathematically talented students. Variables that predict high academic achievement will be used to construct a quantitative model for achievement in mathematics and sciences, and the effects of the chosen variables on mathematics and science achievement will also be studied. Possible explanations for and consequences of dramatic sex differences that have been observed will also be investigated.

TEACHER ENHANCEMENT PROGRAM

Lynn W. Glass	TPE 8751710
Iowa State University of Science &	FY88 $73,524
Technology	Biology
Ames, IA	

"Improvement of Biology Teaching in Central Iowa Through the Use of Integrated Biotechnology Learning Activities"

A network of outstanding biology teachers from Iowa participated in all the design aspects of this proposal which will offer the opportunity for 25 well-prepared biology teachers from central Iowa to participate in a three-week workshop on biotechnology followed by six full-day Saturday sessions. Laboratory activities, computer applications including simulations, the bioethics of the use of this technology, actual teaching strategies for this current topic, and the development of a set of 25 lessons will be the objectives of this program.

These teachers will conduct inservice sessions for their fellow teachers based on these activities and the materials developed, present workshops at professional meetings, and encouraged to write articles for professional science teaching journals.

The Iowa State University and the school districts from which the participants will be selected have cost-shared close to 20% of the cost of the project. In addition, the University supported the establishment of the Iowa Biotechnology Center for Instruction.

COURSE AND CURRICULUM

Elgin H. Johnston	USE 8813895
Jerold C. Mathews	FY88 $49,954
Iowa State Univ of Science & Tech	Mathematics
Ames, IA	

"Planning for a Revitalization of an Engineering/Physical Science Calculus"

In a one-year planning grant, this university's mathematicians will revise the engineering calculus sequence by incorporating modelling and symbolic/graphical/numerical software into the curriculum. The planning will be done by a committee of faculty from engineering, physical and mathematical sciences. A Calculus Network of high school, community college, and college/university will be established.

Iowa State is similar to many mathematics departments at large state universities in that over 90% of the calculus students are from the client disciplines. The project will initiate change in a deliberate and timely manner with concurrence by the client departments.

In the Spring of 1989, one-fourth of the first semester calculus courses will be taught under the revised curriculum. This course will require a small amount of programming, and will stress algorithms and sharply focused real applications. During the Summer of 1989, the second and third semesters of calculus will be revised within the same mathematical framework.

The grantee is cost sharing with funding of in-kind services and indirect cost reductions.

YOUNG SCHOLARS

Bernard J. White	RCD 8850076
Iowa State University of Science and Technology	FY88 $39,278
Ames, IA	FY89 $39,278
	Biology

"Enrichment in Molecular Biology for Young Scholars"

This three-week enrichment program in molecular biology at Iowa State University for twenty 7th and 8th grade students stresses both content instruction and science practice through laboratory experimentation utilizing research techniques and equipment. Participants design, execute and present the results of an independent project and interact with scientists in industrial, government, and academic laboratories.

Twenty-five lectures cover relevant topics in chemistry, biochemistry, cellular and molecular biology, and biotechnology. A college-level text is used as a reference. Participants spend a minimum of 20 hours per week in the laboratory, carrying out over twenty projects and developing research skills. The preliminary results of their independent projects are presented at public forum. Career exploration is emphasized through interactions with scientists, visits to industrial and government laboratories and formal career planning exercises. Participants are encouraged to continue their independent research project during the academic year by means of a mentor program, access to research equipment, and a periodic newsletter. They are assisted in presenting papers at science fairs, symposia and junior academy of science meetings.

COLLEGE SCIENCE INSTRUMENTATION

Dennis Barnaal	USE 8750400
Luther College	FY87 $14,390
Decorah, IA	Physics

"Improvement of Microcomputing in the Undergraduate Physics Curriculum"

The physics department at Luther College will update microcomputer equipment and improve its contribution to physics instruction throughout the physics curriculum. First generation KIM and PET microcomputers were introduced beginning 9 years ago in lower division laboratories and course work. These are now obsolete, and they will be replaced with PC- XT type computer stations in order to keep students abreast of important current technology and introduce new capabilities in the courses.

The upper division curriculum will be strengthened by purchase of new advanced microcomputers: the PC-AT 16-bit microcomputer, and a 32 bit accelerator board for a Mac-Plus. These will be used to expand instruction in techniques important to the forefront of physics: modeling of complex systems, and the numerical solution of problems by computer. The excellent graphics, very large memory, and high computational speed will permit a new class of problems to be attacked by our students, and also enable new student/faculty research opportunities. In addition, a new telescope mount will be purchased to permit completion of a student-originated research project which involves the computer control of a 14-inch telescope.

COLLEGE SCIENCE INSTRUMENTATION

Anthony L. Heino	USE 8852154
Luther College	FY88 $5,215
Decorah, IA	Chemistry

"Enhanced Instruction in Spectrophotometry"

Improvements and expansion in the teaching of spectrophotometry had been limited by the small number of suitable instruments available in the Chemistry department. Acquisition of the nine spectrophotometers removed this deficiency. The instruments are being used by science students in a number of chemistry courses and by non-science and education students in courses of an interdisciplinary nature. The additional instruments are also permitting more extensive use of spectrophotometry in experiments conducted with area high school students and teachers.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Marian M. Kaehler	USE 8852615
Luther College	FY88 $13,514
Decorah, IA	Biology

"Instrumenting a New Integrated Cellular/Molecular Biology Laboratory for Undergraduates"

Molecular and Cellular Biology are viewed by this department as the primary instrumentation courses offered to majors. These courses are being integrated into a two-semester sequence, and have an extensive laboratory component located in a new molecular biology laboratory. Instruments with three experimental capabilities are being added or upgraded in order to maximize the effectiveness of students' experience: (a) polarographic equipment, (b) an ELISA plate reader and (c) equipment for quantitative assessment of gel electrophoresis runs utilizing photography, densitometry and autoradiography.

A quality laboratory experience should provide students with opportunities to do quantitative work as opposed to mere exercises for illustrating the principle or mechanism of a specific technique. This equipment permits a sophisticated level of hands-on experimentation, introducing students to the current concepts, terminology and techniques of the field. In addition to strengthening the Molecular and Cellular Biology courses, the instrumentation is enhancing laboratory work in Immunology, Endocrinology and Genetics, and significantly broadening the scope of Directed Student Research offered as part of the Biology curriculum.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Carolyn Mottley	USE 8750016
Luther College	FY87 $38,000
Decorah, IA	Chemistry

"Improving Undergraduate Instruction Through Applications of Nuclear Magnetic Resonance Spectrometry"

A recently acquired Nuclear Magnetic Resonance Spectrophotometer is being used in undergraduate instruction in organic, inorganic, physical, and analytical/instrumental chemistry at Luther College. This instrument system, with its enhanced resolution and variable temperature capability allows students first hand experience in the study of molecular structure, stereochemistry, reaction kinetics and thermodynamics.

COLLEGE SCIENCE INSTRUMENTATION

Gloria L. Drapac	USE 8851377
Mount Mercy College	FY88 $69,355
Cedar Rapids, IA	Computer Science

"ADA in Undergraduate Computer Science"

This project introduces topics in data abstraction and concurrent programming at the lower division using the programming language ADA. The curriculum changes are supported by state-of-the art equipment and software.

The laboratory equipment includes: four (4) SUN 3/50M workstations connected to a SUN 4/280S Server through an Ethernet connection and dial-up connections for external users.

In addition to curriculum changes at the lower division, this project introduces workshops for students who have completed the lower division so that ADA can be phased into upper division courses as well.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

John E. Penick	TPE 8652379
University of Iowa	FY87 $328,802
Iowa City, IA	MidSch Science

"Improving Science in Grades 6-9 in Iowa"

This program is designed to assist the middle school science teachers of Iowa in moving toward a curriculum emphasizing the interactions of science, technology, and society. During the summer of 1987 the first 60 teachers, in two sections of 30 each, will study either life science or physical science. The second and third summers will involve 60 teachers in pairs of workshops emphasizing life science, physical science, or earth science, depending on demand and need. These six-day workshops will update participants' content knowledge and provide opportunities to participate in S/T/S learning environments. Teachers attending the summer course will receive one semester hour of graduate credit.

Each group of 60 teachers will be joined by an additional 60 teachers in attending 2 two-day Chautauqua programs. Each year four Chautauqua Conferences will be organized for different geographical areas throughout the state. The initial meeting will focus on such topics as developing a S/T/S rationale, model teaching examples, and on evaluation techniques. A follow-up session six months later will review teacher products, teaching activities, and evaluation efforts. During the period between Chautauqua programs, follow-up will be provided by fifteen area Education Consultants. The

Consultants will visit Chautauqua participants in their areas. These follow-up visits will supplement visits by University of Iowa staff. In addition, a monthly newsletter will provide continuing links to staff and other participants. Those attending the Chautauqua series will receive three semester hours of credit.

During each summer, following the NSF Summer Workshop, a one week Leadership conference will be hosted by the various utility companies of Iowa. The workshop is designed to provide additional background, as well as specific planning for the Chautauqua series held during the following academic year. These teachers will provide examples and expertise in curriculum development and implementation. One semester hour of graduate credit will be awarded upon successful completion of the Leadership Conference.

TEACHER ENHANCEMENT PROGRAM

Edward L. Pizzini TPE 8652312
University of Iowa FY87 $375,563
Iowa City, IA MidSch Science

"Project STEPS - Science Textbook Extensions through Problem Solving"

STEPS (Science Textbook Extensions through Problem Solving) focuses on the implementation and testing of two approaches to developing peer teachers for middle school teachers. Emphasis will be placed on the Search, Solve, Create and Share model of problem solving developed by the Principal Investigator.

During the spring of 1987 forty middle school teachers from school districts surrounding the University of Iowa will attend both a two-day Awareness Conference and six one-half-day workshops. The workshops will emphasize content, methodology, and problem-solving. During the summer of 1987 twenty-five of the teachers will be invited to attend an intensive three week Leadership Training Workshop. The purpose of the workshop is to present additional science content, learn research methodology, interact with research scientists, review curricular material and develop the procedures necessary to conduct inservice activities. During the school year of 1987-88 the Leadership Teachers will attend nine seminars which will reinforce the work presented during the summer. The staff will work with the teachers to utilize the methods and materials developed during the summer. The same twenty-five teachers will attend a two-week facilitator program designed to finalize the design of the inservice program. During the 1988-89 school year the Peer Teachers will work with other teachers in their districts.

A comparison group of Peer Teachers will be developed through an accelerated program consisting of a two-week concentrated workshop during the summer of 1989. These Peer Teachers will conduct inservice activities during the school year of 1989-90. An extensive evaluation program will compare the effectiveness of the two groups of peer teachers.

In addition to the problem solving techniques, the program will result in the production of the following: a Facilitator Training Handbook for implementing, evaluating, and managing inservice programs; Technique Training Video Tapes for learning the problem solving approach; a newsletter; and an electronic bulletin to exchange information among the participants.

TEACHER ENHANCEMENT PROGRAM

James A. Shymansky TPE 8751680
University of Iowa FY88 $149,258
Iowa City, IA FY89 $206,125
FY90 $208,149
FY91 $148,509
FY92 $ 51,191

"Teachers Studying Science Teaching"

This project will be designed to educate participants to become aware of how different teaching methods affect student understanding of selected science concepts. Building on teacher interest in doing classroom research, the model will bring teachers to a summer workshop where they will become part of a classroom research team. In order to study how teaching methodology effects learning, the middle school teachers in this project will need to acquire a deep understanding of the science topics to be investigated, strategies for teaching for conceptual change, and methods for determining levels of student understanding. The first year's inservice program and academic year follow up will deal with selected physics topics and the conceptual change teaching model. During the second year, leaders from twenty-five school systems will receive instruction so that they can conduct similar projects in their own systems. Years three and four will involve expanding the model to the life and earth sciences. During year five, a guide for developing such inservice programs will be produced and disseminated.

TEACHER ENHANCEMENT PROGRAM

Keith D. Stroyan TPE 8751822
Harold L. Schoen FY88 $256,226
University of Iowa Mathematics
Iowa City, IA

"Improving Secondary School Geometry Instruction in Iowa"

The main goals of the project are to improve the quality of geometry instruction in secondary schools by developing inservice leaders throughout the state of Iowa. There are to be intensive summer workshops offered for 68 prospective leaders during the summers of 1988 and 1989. Some of the topics to be emphasized in these courses deal with geometric transformations and vector analytic geometry applied to computer graphics. The workshops also deal with didactical issues such as new directions in the geometry curriculum and methods of presentation of the new topics. Three or four master teachers are to be chosen to contribute to the instructional staff by demonstrating modern methods and materials. They are to serve as associates in the workshops. Mathematics supervisors from the State Department of Education and the regional education agencies in the state are to assist the project by helping to select the leaders as well as providing assistance in planning and implementing the inservice network that is to develop as a product of the project.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Pete L. Trotter	MDR 8751113
James A. Shymansky	FY87 $125,290
University of Iowa	FY88 $ 10,827
Iowa City, IA	FY89 $ 59,940
	Physics

"Using the Computer to Overcome Misconceptions in Physics"

Students bring many misconceptions to high school science classes. This project will focus on misconception within physics, specifically mechanics, and on how the use of computers can help correct many of these faulty views. In particular, the project will develop a series of software modules using unique characteristics of computers, such as their interactive, adaptive, and graphic capabilities, to address previously documented misconceptions.

The project's modules will be based on a generative model of student learning and will contain computer activities, such as real-time data collection, simulations, and problem solving exercises, for both students and teachers. The software for the modules will be programmed to work with commercially available laboratory interfacing equipment.

Activities are divided into five phases: (1) the design of modules and development of prototypes; (2) the review and revision of the modules; (3) evaluation of materials in high school physics and university science education classes; (4) revisions based on evaluations; and (5) dissemination through regional and national workshops, teacher development programs, and COMDUIT's national channels.

Attempts are being made to overcome student misconceptions which have been identified through research in teaching and learning. This project will continue this important work, using the approach of instruction through the use of the microcomputer and appropriate software. It will also increase the knowledge base on effective ways for more successful learning of physics.

The FY88 supplement will allow the participation of a member of the physics department of Coe College in the research and development taking place at Iowa University and CONDUIT.

TEACHER ENHANCEMENT PROGRAM

Karen A. Dotseth	TPE 8751718
Jack D. Wilkinson	FY88 $115,350
Beverly W. Nichols	FY89 $159,575
University of Northern Iowa	FY90 $164,131
Cedar Falls, IA	FY91 $ 72,031
	Mathematics

"Teachers Teaching Teachers"

The main goal of the project is to enable the Council of Presidential Awardees in Mathematics (CPAM) to conduct a series of workshops and seminars for teachers of mathematics at two main sites in the country, namely the University of Northern Iowa and the University of Northern Arizona. Over a three-year period 300 teachers of mathematics will receive inservice educational experiences to update their knowledge of mathematics and modern pedagogical practice. An honors seminar will be held for fifty participants for two weeks each June during which there will be lectures, discussion groups and planning sessions. The instructional staff consists of past Presidential Awardees cooperating with faculty members at the University of Northern Iowa. Also, some past Presidential Awardees will be participants in the seminars along with other talented teachers of mathematics. Later in each summer, the leaders who have experienced the honors seminar will conduct two-week inservice sessions for other teachers at other universities. Three workshops are planned: one will focus on issues of teaching and learning mathematics at the middle school/junior high school levels; a second will emphasize questions related to geometry; a third is to focus on discrete mathematics. Problem-solving, applications, the integration of computers, and techniques of instructional methodology are aspects of all the workshops. The follow-up activities include one-day sessions to be held each semester as well as visitations by the workshop leaders at the schools of the participants. A newsletter is planned as are research components related to each of the planning groups. The non- NSF cost sharing is approximately eleven percent of the funded amount.

COLLEGE SCIENCE INSTRUMENTATION

Nancy P. Hamilton	USE 8853326
University of Northern Iowa	FY88 $12,174
Cedar Falls, IA	Biology

"Motion Analysis in Undergraduate Kinesiology"

The mechanics of human motion is taught through the use of a video/computer motion analysis system. This system is incorporated in laboratory experimentation in courses in undergraduate Kinesiology. The motion analysis system is applied directly to the teaching of Kinematics and indirectly to the teaching of Kinetics. The equipment consists of a 2D video analysis unit, a computer subsystem and a video subsystem.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Roger J. Hanson	USE 8852598
University of Northern Iowa	FY88 $10,180
Cedar Falls, IA	Physics

"Improvement of Undergraduate Acoustics Laboratory Instruction"

The grantee institution will purchase a dual-channel, real-time spectrum analyzer, x-y recorder, calibrated sound power source, and an integrating sound level meter. This equipment will be used to improve instruction in acoustics courses both for Physics majors and non-majors. The spectrum analyzer will be used to examine phase differences between different parts of sound systems, and to look at the dynamic structure of sound spectra. The calibrated sound power source will permit several new experiments to be added to the courses, and the sound level meter will be used to analyze noise sources. Advanced undergraduates also will be able to use the new equipment in research projects.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Dale W. Olson	USE 8750915
University of Northern Iowa	FY87 $9,799
Cedar Falls, IA	Physics

"Improvement of Undergraduate Optics Laboratory"

The Physics Department at the University of Northern Iowa will improve experiments in two courses, Holography Laboratory and Lasers and Optics. It will add new experimental capabilities in the areas of holography, lasers and fiber optics. These improvements will also support work by students registering for Undergraduate Research which is required as part of the new Bachelor of Science Program.

New instrumentation to be used includes open-cavity lasers, an electronic driver for a laser spectrum analyzer (previously purchased), a fiber optics lab instruction system, fiber holders, a laser power meter, a fiber cleaver/splicer, a holography table with vibration isolation, and an interferometer useful for characterizing aberrations of lens and holographic optical elements.

TEACHER ENHANCEMENT PROGRAM

Roy D. Unruh	TPE 8652448
Timothy M. Cooney	FY87 $140,042
University of Northern Iowa	Physics
Cedar Falls, IA	

"Physics Resources, Instructional Strategies and Content Workshops"

This project is centered around 2 three-week summer workshops for 30 participants each selected from among physics teachers in the upper midwest. The workshops will stress use of PRISMS--Physics Resources and Instructional Strategies for Motivating Students. This teacher's guide has been developed and field tested by the Iowa Physics Task Force. Conference telephone calls and videotaped lessons will be part of follow-up activities. Each of the 2 three-week sessions will include instruction in mechanics, thermodynamics, optics, electricity and magnetism, and atomic and nuclear physics. Participants will also study and apply learning models and integrate the PRISMS learning cycles with the texts that they use in their classrooms.

During the academic year following the summer's activities, participants will be linked in small groups via telephone conference calls. In addition, each participating teacher will be required to supply one videotaped classroom lesson during each 12-week period. These will be evaluated by project staff.

Requirements for selection include an assignment to teach physics in 1987-88, less than 18 semester hours of credit in physics, and a commitment to use PRISMS materials in their teaching. Statements of support from the school administrator must accompany the application. This includes the availability of certain video and telephone equipment. Participants will be housed at the University of Northern Iowa, the location of instruction, and their expenses will be borne by the grant. Each will receive a stipend of $200 per month. Three semester hours of graduate credit will be awarded for the summer workshop and another hour of credit will be awarded on completion of the academic year outreach activities.

The primary administrative and instructional responsibility for the program will be lodged with Professor Unruh of the UNI physics department and Professor Cooney of the education department. Content lectures will also be given to seven physicists from the host institution. Six master teachers have been identified, and two will be in residence at all times during the summer workshops. In addition, they will assist in the evaluation of the videotaped lessons produced by participants during the academic year.

TEACHER ENHANCEMENT PROGRAM

Roy D. Unruh
University of Northern Iowa
Cedar Falls, IA

TPE 8751784
FY88 $198,707
Physics

"PRISMS - Physics Resources and Instructional Strategies for Motivating Students"

PRISMS - Physics Resources and Instructional Strategies for Motivating Students is a two-year leadership project at the University of Northern Iowa to increase achievement in high school physics and to cultivate reasoning and problem solving skills in science. Fifty well qualified physics resource teachers from throughout the country will be trained in the use of materials and strategies that have been developed and validated by the Iowa Physics Task Force. The materials include a teacher's resource guide, Physics Resources and Instructional Strategies for Motivating Students (PRISMS), which contains more than 125 activities. The program emphasizes "learning cycle" pedagogy. It includes a three-week workshop during the first summer of operation, and extensive academic year follow-up activities. Participants who successfully complete the academic year leadership component will receive up to 2 units of graduate credit.

TEACHER PREPARATION PROGRAM

Robert T. Ward
Jack D. Wilkinson
University of Northern Iowa
Cedar Falls, IA

TPE 8851116
FY88 $128,740
FY89 $230,833
FY90 $273,458
FY91 $190,976
FY92 $119,140
Elem Math/Science

"Preparation of Elementary School Mathematics and Science Teachers"

This project will develop a model for preparing science and mathematics teachers for elementary school. The model is comprehensive, beginning ith the students' first preservice courses through the first years of teaching. Project faculty will develop courses that integrate content, learning theory, and teaching strategies. Field experience and student teaching will take place in the classroom of teachers whose philosophy and pedagogy are consistent with project goals. A support network to ease the transition time from preservice to inservice teaching will be developed among school administrators, university faculty, educational service personnel, lead and mentor teachers, and graduates of the project. This network will, at the same time, develop a broad base of support for the project goals. Such a network of committed people involving so many levels of our educational institutions will insure the continuation of the project goals.

The project will have approximately 25% cost sharing from the institution.

COLLEGE SCIENCE INSTRUMENTATION

Ching S. Woo
University of Northern Iowa
Cedar Falls, IA

USE 8853044
FY88 $11,922
Chemistry

"Electrochemical Equipment for the Instrumental Analysis Laboratory"

Electrochemical methods are becoming increasingly important in the studies of Chemical, Biomedical and Environmental Sciences. Laboratory experience is being offered in the principles and techniques of contemporary electroanalytical methods to Chemistry majors and other science students enrolled in instrumental analysis courses. The BAS 100A electrochemical analyzer capable of performing a wide variety of controlled potential techniques and computer data handling is being utilized in inorganic and organic trace analyses, kinetics and mechanism studies. The voltammetric techniques are being taught via an integrated electrochemistry workstation in a simple, rational and stimulating manner. Students who are generally more familiar with spectrochemistry and chromatography are also using electrochemical techniques to equal advantage in solving analytical problems in their independent projects and undergraduate research. In addition, students in an Environmental Chemistry course are applying the electrochemical techniques to investigate "speciation" of metals and anions in electrochemical samples.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Mohamed Ellid	USE 8750536
Wartburg College	FY87 $6,665
Waverly, IA	Physics

"Application of Mossbauer Spectroscopy in Undergraduate Laboratories"

Mossbauer Spectroscopy allows detailed chemical, structural and magnetic information to be obtained about atoms on the surface of a solid or within its bulk. The Wartburg Physics Department will acquire equipment to allow upper division students to use this valuable technique. It will be used in upper level laboratories for physics majors and in student projects. One of the projects will be aimed at characterizing the active phases of iron and iron-component catalysts and examining the catalytic properties of these phases. The equipment needed for this project are a multichannel analyzer, velocity transducer, function generator, drive generator, high voltage supply, detector, pre-amplifier, amplifier and single channel analyzer, and radioactive source.

KANSAS

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Donna S. Cooper
Science
Hays High School
Hays, KS

Nick Dolloff
Mathematics
Minneapolis High School
Minneapolis, KS

1988

Anna S. Neal
Mathematics
Wichita High School Southeast
Wichita, KS

H. Dean Jernigan
Science
Shawnee Mission South High School
Overland Park, KS

TEACHER ENHANCEMENT PROGRAM

Alfred D. Brothers	TPE 8652297
Benedictine College	FY87 $173,939
Atchison, KS	Multidisciplinary

"A Program of Coursework and Long-term Professional Support for Multiple Discipline Secondary Science and Mathematics Teachers"

Benedictine College will conduct a four-week workshop for 140 teachers in Iowa, Kansas, Missouri, and Nebraska. The workshop will emphasize instruction in physics, chemistry, biology, and mathematics. Each teacher will participate in one of the four major areas of program. The instruction will focus on content and the development of materials that are to be implemented in the classroom. All teachers will participate in a series of interdisciplinary workshops. An optional computer workshop will be provided for teachers who want to learn or practice basic computer concepts.

The staff is composed of master secondary teachers and college faculty. The participants will conduct inservice activities during the academic year for other teachers in their school system. Over a two-year period the college staff will make site visits to each participant's school. Teachers will be encouraged to attend professional meetings and make presentations at these meetings. Some financial support will be provided for teachers who attend these meetings.

The school districts from whom participants are chosen are being encouraged to provide support for inservice activities and to purchase additional equipment and materials that will enhance their mathematics and science programs. The professional organizations in the states will cooperate in coordinating and providing support for this project. The concerns of many small and rural schools will be addressed.

COLLEGE SCIENCE INSTRUMENTATION

Graham W. Ellis	USE 8851628
Benedictine College	FY88 $14,370
Atchison, KS	Chemistry

"Integration of Modern Chromatographic Instrumentation into the Undergraduate Chemistry Curriculum"

A Gas Chromatograph (GC) and High-Pressure Liquid Chromatograph (HPLC) are improving laboratory instruction in Analytical Chemistry, Biochemistry, Organic Chemistry, Physical Chemistry, Chemistry for Non- Science Majors, General Chemistry and Advanced Laboratory Courses as well as Undergraduate Research. The acquisition of GC and HPLC instruments is enhancing student understanding of a) the fundamentals of chromatographic science; b) the utilization of GC and HPLC for qualitative and quantitative analysis of chemical systems; c) the utilization of GC and HPLC for investigating reaction mechanisms; and d) the utilization of GC and HPLC for separation and purification of chemical compounds.

As GC and HPLC instruments are found in most governmental, industrial and academic laboratories, the introduction of these instruments into the undergraduate chemistry program is better preparing the students for future employment in the chemical profession. Also the use of GC and HPLC instruments in introductory courses for non-science majors is acquainting these students with the use of one of the major principles and methods in chemistry.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Mike L. Mitchell	USE 8750702
Bethany College	FY87 $26,350
Lindsborg, KS	Chemistry

"Improvement of Undergraduate Chemistry Curriculum by Addition of an NMR Spectrometer"

Undergraduate chemistry instruction has been enhanced at Bethany College by the acquisition of a nuclear magnetic resonance spectrometer. Students are provided with opportunities to obtain real spectra of synthesis products and to study chemical phenomena such as metal ion complexation and acid-base equilibria. This acquisition is part of a five year plan by the Chemistry Department to improve laboratory instrumentation.

TEACHER ENHANCEMENT PROGRAM

Dean A. Zollman	TPE 8751332
Thomas R. Manney	FY87 $295,730
Angelo Collins	Biology
Kansas State University	
Manhattan, KS	

"Regional Continuing Education on Modern Genetics for Secondary School Teachers"

This project addresses the task of keeping the high school and middle school curriculum current in the area of contemporary genetics by providing continuing education, inservice, and logistical support to a selected and diverse group of teachers throughout the state of Kansas. For maximum effectiveness the scope is focused on the specific, interdisciplinary topic of molecular genetics and the genetic effects of radiation, using yeast cells as a model system. However, the need that is addressed and the approach taken should be appropriate for any field where progress in research and technology is moving too fast for the standard teacher education and curriculum development pathways to respond in a timely fashion.

The project has been designed, and will be implemented, by an interdisciplinary team of professionals with strong commitments to the improvement of science education. They represent professional competence in research in the discipline, research in science education, and classroom teaching at the secondary and post-secondary school levels. They include university faculty members from the Kansas State University (KSU) Departments of Physics, Biology, and Curriculum and Instruction, a graduate student in Curriculum and Instruction, and high school science teachers. Thirty secondary school science teachers will participate in the program during each of two years.

Each of the one-year periods will begin with a three-week, intensive summer workshop on the KSU campus to introduce the participating teachers to the content, teaching strategies, and technology. Using this knowledge base, the participants will develop lesson plans under the close guidance of the staff. The lessons will utilize laboratory experiments in yeast genetics, microcomputer software, video materials, and the critical thinking skills of problem solving and concept mapping.

During the subsequent school year these lesson plans will be implemented in the participants' classrooms. The project staff will provide continuing support during this phase. Follow-up and consultation will be facilitated through a 24-hour computer bulletin board and electronic mail service, a series of teleconferences, a weekend conference associated with the annual conference of the Kansas Association of Teachers of Science, as well as individual consultation by telephone and mail. These communication channels will provide continuing contact between the project staff and the participating teachers as well as offering the teachers several ways to communicate directly with each other.

An important contingent of the project staff will be peer teachers who have taught these materials. During the first year these will be teachers who participated in a related NSF-sponsored workshop and teleconference project in 1985. During the second year of the project the pool of peer teachers will expand to include the teachers from the first year. By keeping the lines of communication open to all current and previous participants we will develop a network of teachers who can share experiences and information and who can be provided continuing support by the project staff and subsequently, by the KSU Center for Science Education.

COLLEGE SCIENCE INSTRUMENTATION

Richard P. Zerger	USE 8851437
McPherson College	FY88 $13,950
McPherson, KS	Biology

"Bio-Analytical Instrumentation for Undergraduates in the Chemical and Biological Sciences"

This project provides improved laboratory instrumentation to prepare undergraduate students majoring in the chemical and biological sciences for careers in areas associated with biotechnology. This project is part of a larger plan to restructure the curriculum and associated facilities to meet the changes required in chemical and biological education. The High Performance Liquid Chromatography (HPLC) system will complement an existing core of analytical instruments and methods available to students in the laboratory portion of the courses, Biochemistry and Instrumental Analysis, taken by Chemistry and Biology majors, and in the Interdisciplinary Undergraduate Research Program in which all chemical and biological science majors are required to participate. The availability of HPLC will permit laboratory instruction in HPLC techniques and will greatly expand the research topics available to students in the area of biochemistry.

The grantee is matching the NSF award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Norma Steinman	USE 8852226
Neosho County Community College	FY88 $7,640
Chanute, KS	Chemistry

"Atomic Absorption in a Cooperative Project with Local Industry"

This community college is acquiring an Atomic Absorption Spectrometer for use in Beginning Chemistry as well as in continuing education. Local industrial firms are supplying samples that can be used for analysis giving the students an opportunity to learn chemistry on items with which they are particularly familiar. One manufacturing plant is a circuit board plating plant and does extensive metal analysis, and the other is involved in working with a Vermiculite used in animal feed. Both provide opportunities for interesting student involvement and a challenging opportunity for the students.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Barbara Kushan	TPE 8652352
St Mary College	FY87 $263,440
Leavenworth, KS	Computer Science

"A Model Program for Preparing Computer Studies Teachers"

Saint Mary College will develop, execute and disseminate a three-year Model Program for Preparing Computer Science Teachers for forty participants who teach at the middle and high school levels in Kansas.

This project will provide a computer studies teacher program that meets the guidelines for certification in Kansas. It will educate teachers in computer studies so that they can then conduct in-service sessions in computer literacy for teachers in their districts. It will provide a forum where teachers from various districts can share their materials and ideas about computer learning and develop a model program of computer studies in education, that has been tried and tested by teachers in the field and can be shared with other State Education Departments.

Participants in this program, which encourages interdisciplinary connections, will receive graduate credit for their coursework. Each site where a participant teaches will be visited each year by Craig Haugness, Computer Specialist for the Kansas State Department of Education. He will submit a formal evaluation of the entire project. Saint Mary College is making plans to sustain the program at the end of NSF funding.

The PI, Sister Barbara Kushan is Director of Academic Computing at Saint Mary College. Other staff members are Sister Andrea Johnston, PhD, chairperson of the Mathematics Department, Professor Victor Meyer, Sister Mary Erwin Baker, Sister Mary Denise Sternitzke, and Sister Kathy Atkins all of whom are experienced mathematics and computer science faculty members.

Saint Mary College is qualified in terms of staff, facilities and commitment to develop a program to prepare computer teachers. Cost sharing by the College is 30% of the overall budget.

TEACHER ENHANCEMENT PROGRAM

Walter S. Smith
University of Kansas Main Campus TPE 8751720
Lawrence, KS FY88 $403,865
Elem Science/Math

"Science/Math Instructional Improvement for American Reservation Indian Students"

The main goals of the project are to offer to 70 elementary and middle school teachers over a sixteen state region and at schools that service primarily American Indian students an inservice program that has been piloted on a much smaller scale on funds contributed by the Bureau of Indian Affairs (BIA). It is intended to build up a cadre of 70 mathematics and science teacher-leaders for the BIA operated elementary and junior high schools across the country. These leaders are to take on various roles, such as providing demonstration lessons, conducting inservice sessions, coordinating curriculum development and working with local agencies to plan improvements at the school or regional levels. The activities are centered around workshops and their extensions that were developed in the pilot studies over the past three years. The initial summer workshop covers a period of eight weeks and emphasizes these activities: 1) there are to be mathematics courses taught by the project director according to the methods developed from the pilot experience; 2) one of the senior faculty members, with assistance from the staff and participants of the pilot, emphasizes diagnostic and remediation methods for mathematics skills; and 3) applications of science and mathematics teaching are to be developed for the American Indian setting by two of the staff members who have experience in this area and are assisted by a teacher from a reservation who has applied these methods in her teaching. Graduate college credit is available to the participants upon request. There are to be extensive science and mathematics laboratories and field trips under the direction of the instructors. The BIA plans to contribute significantly to the project as well as to provide input to the project plan and selection of teachers. The BIA, for example, will fund the development of a curriculum kit at one of the target schools and will build on the previous work to help in the implementation of the cadres' contributions in the local regions.

TEACHER ENHANCEMENT PROGRAM

R. Neil Schimke TPE 8652370
Kenneth J. Bingman FY87 $332,916
Laura L. Thompson Biology
Debra L. Collins
M. Virginia Epps
University of Kansas Medical Center
Kansas City, KS

"Human Genetics and Curricular Training for Lead Teachers"

This project will establish an inservice program to incorporate human genetics into the elementary school curriculum. During the summer of 1987 two five-day Peer Leadership Workshops, one for thirty-five elementary teachers and one for thirty-five secondary teachers, will be held in each of two regions in Kansas. The participants will receive instruction in human and medical genetics including information concerning genetic engineering. In addition to basic content the participants will also develop the methodology of examining and conducting student discussions of controversial issues such as gene therapy, recombinant DNA, genetic screening, and genetic counseling. The laboratory work will provide experiences with the BSCS materials and with recombinant DNA technology.

During academic year 1987-88 the staff members will work with the Peer Leadership Teachers in their classrooms to insure mastery of the materials and the ability to successfully utilize the materials. In the spring of 1987-88 the seventy teachers from each of the two regions will attend a two-day workshop to be held in each region. This workshop will conclude the formal preparation of the peer teachers to present inservice programs to their peers. During the 1988-89 school year, the thirty-five elementary teachers and the thirty-five secondary teachers of each region will implement the inservice program by using the materials and the content videotapes produced during the first year of the program.

Two hours of credit will be awarded upon successful completion of the Peer Leadership program.

The project will be coordinated and directed by geneticists from the Medical Genetics Division Department of Medicine, University of Kansas Medical Center. The staff consists of R. Neil Schimke, clinical geneticist, Debra L. Collins and Laura L. Thomson, genetic counselors, three master teachers (including two Presidential Awardees), and lecturers from the other universities in the state. The various university divisions, support agencies, and school districts have made substantial contributions to the program.

COLLEGE SCIENCE INSTRUMENTATION

Betty J. Cole
Thomas M. Wolf
Washburn University of Topeka
Topeka, KS

USE 8750077
FY87 $27,607
Biology

"An Ultracentrifuge and a Spectrophotometer for an Undergraduate Molecular Biology Laboratory"

As many undergraduates are moving away from an interest in medicine and descriptive biology into the research and technical areas of Molecular Biology, it becomes increasingly important to expose them to basic methods of ultracentrifugation and spectrophotometric analysis. The Department is changing its curriculum to offer an emphasis in Microbiology and Molecular Biology to meet this change in student interest.

The new equipment (ultracentrifuge and UV/Vis/ spectrophotometer) purchased through this award is being used for experiments in six different laboratories as well as in independent student research projects. This broadly based exposure is ensuring that the students have multiple chances to use and become familiar with this instrumentation and its uses.

COLLEGE SCIENCE INSTRUMENTATION

Fred L. Yaffe
Washburn University of Topeka
Topeka, KS

USE 8750212
FY87 $16,142
Psychology

"A Computer Laboratory for the Teaching of an Interdisciplinary Course in Psychology and Legal Issues"

In order to teach scientific principles and methods to non-science oriented majors in an applied area, the project will establish an interdisciplinary course in Psychology and Legal Issues, using a microcomputer laboratory. There has been an increasing use of social scientific reasoning and methodology for understanding legal issues. Many pre-law students receive little if any instruction in the scientific method or any experience conducting research and handling research data, experiences which will ultimately enhance their proficiency as future lawyers. A microcomputer laboratory component containing 20 Apple IIc Micro-systems will be used in a Psychology and Legal Issues course jointly taught by faculty in the Psychology and Political Science Departments and the School of Law. It will provide an interactive and experiential capability for teaching scientific methods and principles to non-science majors. In addition the microcomputer laboratory will enhance the curricula of both the Psychology and Political Science Departments by being available for use in existing experimental and statistical courses.

YOUNG SCHOLARS

Barbara E. Bowman
Russel G. Pinkerton
Wichita State University
Wichita, KS

RCD 8850190
FY88 $58,067
FY89 $58,067
Engineering

"Mid-American Young Scholars in Science and Engineering"

This project provides a summer residential enrichment experience for thirty high school juniors in the central part of the United States. The four-week project has three components: (1) a two week workshop concentrating on career exploration, science and engineering ethics, and research methodology and engineering design; (2) a one week engineering or science research project involvement; and (3) one week of "shadowing" a scientist or engineer in industry.

The workshop component uses a variety of instructional methods, including case studies and problem solving sessions. During the research component, students apply what they learned in the workshop to a research setting as part of a research team. Students complement the career exploration portion of the workshop with their industrial shadowing component. Both the research and shadowing experiences emphasize the importance of ethics in science and engineering. Academic year follow-up activities include monthly activities by students in their schools, and two group meetings at WSU.

KENTUCKY

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Raymond E. Farrar
Science
Atherton High School
Louisville, KY

Donn R. Manker
Mathematics
Campbell County High School
Alexandria, KY

1988

Lawana Scoville
Science
Laurel County Junior High School
London, KY

Jo Ann Mosier
Mathematics
Fairdale High School
Fairdale, KY

TEACHER ENHANCEMENT PROGRAM

John M. Daly
Bellarmine College
Louisville, KY

TPE 8751824
FY88 $91,023
Chemistry

"Integrative Approach to Teacher Enhancement in Chemistry"

An Integrative Approach to Teacher Enhancement in Chemistry is a 20-month program aimed at enhancing the capabilities of 20 high school chemistry teachers from a five-county region in the vicinity of Louisville, Kentucky. These teachers will participate in two five-week summer workshops and three one-day in-service meetings. The workshops will emphasize training in chemical structure and bonding, chemical demonstrations, simple computer simulations and computer assisted instruction in chemistry. Participants will receive two units of graduate credit for each completed summer workshop. These teachers also will provide in-service training for other chemistry teachers in the area.

PRIVATE SECTOR PARTNERSHIPS

Robert Glass
Eileen B. Young
Larry Skutchan
Kathryn D. Smith
Council for Retarded Citizens
of Jefferson County Inc
Louisville, KY

TPE 8851075
FY88 $153,472
FY90 $123,292
Other NEC

"Practical Applications of Advanced Technologies: Disabled Citizens Computer Center"

Working in a Disabled Citizens Computer Center, which will be part of the National Education Special Alliance established by Apple Computer, a team will develop and test modified educational software for use by visually-handicapped individuals. Under the direction of experienced staff loaned by the American Printing House for the Blind (APH), existing educational software from the Minnesota Educational Computing Center will be modified to give speech/auditory output. Much of the work of conversion will be done by students in computer classes from the Louisville Central High School Computer Technology Career Magnet Program; the educational opportunity provided for these students is an important element of the program. Teachers will be trained to use the materials and will test their utility in practice. Dissemination of finished materials and recommended methods of use will be through the Apple sponsored network and APH.

Cost sharing by the partners will total 31% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Jeffrey H. Baxter
Eastern Kentucky University
Richmond, KY

USE 8750036
FY87 $32,847
Chemistry

"Update of Equipment Used in Undergraduate Biochemistry Labs"

The Chemistry Department at Eastern Kentucky University has recently acquired the equipment needed to develop and implement modern, instrumentation-oriented laboratory courses in biochemistry. This equipment (which represents the basic tools of the biochemist) includes spectrophotometers, a high-speed centrifuge (used in almost every phase of biochemistry), and electrophoretic apparatus (used in the characterization and purification of many types of large molecules). The use of this instrumentation, together with other important equipment such as clinical centrifuges (for applications not requiring high speed), and chart recorders (to record data on a continuous basis), affords students excellent laboratory experiences in biochemistry and provides them with better preparation for advanced study.

COLLEGE SCIENCE INSTRUMENTATION

Karan Kaul — USE 8750558
Kentucky State University — FY87 $7,510
Frankfort, KY — Biology

"Equipment to Improve Undergraduate Instruction in Cellular and Developmental Biology"

Use of the new computer-interfaced spectrographic equipment provided through this project is improving laboratory instruction in Developmental and Cellular Biology courses. The students in this historically Black institution are being exposed to current state-of- the-art equipment in laboratory studies of functional aspects of living systems.

Although the primary emphasis is on Cellular and Developmental Biology, instruction in Biochemistry, Human Physiology, Human Anatomy, and special projects also benefit greatly from the project. One of the most important elements of the project is its introduction of modern data collection and analysis techniques to the Department's curriculum.

COLLEGE SCIENCE INSTRUMENTATION

David F. Oetinger — USE 8750098
Kentucky Wesleyan College — FY87 $15,143
Owensboro, KY — Biology

"Immunology--A New Capstone Course for Undergraduate Biology Majors"

A new capstone course required of biology majors is being created. Immunology is replacing the course which has served a capstone function for the past 22 years, Plant Physiology. Immunofluorescence electrophoretic procedures, and cell culture--hybridoma production are becoming part of a revised Immunology laboratory curriculum. This revised curriculum is seeking to ensure that biology majors are knowledgeable and well-trained in the areas of experimental design; discipline in experimental work; care of living organisms; precision in manipulative work; use of instrumentation; data collection; data analysis; and report writing. Microscopes, protein electrophoresis and immunoductrophoresis equipment are being used by the students. Specifically, the immunology laboratory includes three new project areas in which students generate and test hypotheses: humoral immunity (producing antisera to soluble antigens, protein determinations, and fusion demonstrations of antibody specificity and titer), immunolabelling (producing antisera to bacterial antigens, purifying and labelling antibodies and subsequent demonstration of their specificity with immunofluorescence), and cellular immunity" (demonstrating populations of T- and B-lymphocytes, culture of mouse myeloma cells, fusion of myeloma cells with stimulated mouse splenic lymphocytes, and attempts to identify monoclonal antibody- producing cells).

COLLEGE SCIENCE INSTRUMENTATION

Lloyd E. Story, Jr. — USE 8851279
Maysville Community College — FY88 $5,887
Maysville, KY — Biology

"Micro-Computer Interfaced Equipment for Instructional Laboratories in a Community College"

The microcomputer hardware and software provided through this project are adding versatility to existing laboratory equipment and providing a new dimension to the science curriculum. It allows for the interfacing of microcomputers and transducers with existing hardware so that these two-year college students can perform laboratory experiments with greater rapidity, thus gaining more time for the interpretation of data, for better data analysis and for critical evaluation of the experimental designs and scientific methods being employed. Students are able to pursue independent problems and projects closer to the true nature of work done in professional scientific laboratories.

The video camera supplements students' individual use of laboratory microscopes, enabling the instructor to illustrate important microscopic concepts by projecting permanent or wet-mount slides so that they may be examined and discussed by all students at the same time. Life activities of microorganisms also can be observed simultaneously in the group setting.

All the new equipment provides students with greater opportunities to experience inquiry-centered instruction, thus helping them to build critical thinking skills. The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Arlene R. Courtney — USE 8750472
Murray State University — FY87 $50,000
Murray, KY — Chemistry

"Integration of Multinuclear Magnetic Resonance Spectroscopy into a Modern Chemistry Laboratory Program"

The addition of a broad band Fourier Transform Nuclear Magnetic Resonance (FTNMR) system to the instrumentation available in the Chemistry Department at Murray State University is allowing the introduction of the theory and practice of multinuclear FTNMR into the undergraduate chemistry curriculum. Initial use of the system begins in the first semester organic laboratory course, with increased utilization thereafter in second semester organic, as well as in subsequent upper division laboratory courses. These include physical chemistry, inorganic laboratory, instrumental analysis, and spectrometric identification, as well as undergraduate research.

TEACHER ENHANCEMENT PROGRAM

Vaughn Vandegrift TPE 8652336
Murray State University FY87 $199,030
Murray, KY Chemistry

"Regional Summer Workshop for High School Chemistry and Physical Science Teachers"

The major element in this project is an intensive six-week summer workshop for 24 high school teachers of chemistry and physical science drawn primarily from Kentucky. The workshop will consist of formal chemistry coursework in the fundamentals of chemistry, with particular emphasis on inorganic chemistry, laboratory work, the development of demonstrations, computer assisted instruction, and a component focussing on the teaching of science in secondary schools. Follow-up activities in the academic year include monthly meetings of groups of 4-7 participants and four general meetings of all participants. The project will be conducted in each of two project years, with a separate set of participants in each year.

Teachers having the least formal or poorest training in chemistry will be given top priority in the selection process. Priority will also be given to those who have not had recent experience or instruction updating their knowledge of the discipline. Individual commitment will be assessed by telephone interviews with the applicants, and institutional support will be generated through a special conference for the principals of the teacher participants.

Participants will receive graduate credit in both chemistry and education. Except for the commuters, participants will be housed at the site of the workshop, Murray State University.

This project is carefully planned, well balanced, and has the potential of being of considerable benefit to the participants and their colleagues.

YOUNG SCHOLARS

Linda Sheffield RCD 8850081
Northern Kentucky University FY88 $36,744
Highland Heights, KY Other NEC

"Young Scholars Program"

The goal of this Young Scholars Program at Northern Kentucky University is to increase the awareness and interest of junior high school and high school students in mathematics, science and engineering as potential career options, by presenting these fields as the tools to solve exciting problems. A two-phase program for forty 8th, 9th and 10th graders provides the necessary opportunities. The first phase is a five-week commuter program during the summer of 1988, where activities focus on research methodology. The academic year workshop focuses on selected topics in science and mathematics. Again, these activities not only increase participants' skills in math and science, but encourage them to select courses in school that will allow them to pursue careers in science, engineering and mathematics.

YOUNG SCHOLARS

Ray M. Bowen RCD 8850242
Cynthia S. Iten FY88 $24,144
University of Kentucky FY89 $24,144
Lexington, KY Engineering

"NSF Young Scholars - Engineering Ahead!"

The University of Kentucky College of Engineering conducts a two-week residential summer program for twenty high school seniors to introduce them to the engineering profession and to encourage them to pursue careers in engineering fields.

The program consists of discussion sessions, laboratory experiences, field trips, and lectures to thoroughly acquaint the students with several different engineering disciplines, career opportunities, required educational preparation, and ethical practices of the engineering profession. Interdisciplinary programs in biomedical engineering and pharmaceutical engineering are also introduced to the participants. Staffing includes faculty, staff, graduate students, and undergraduate students from the College of Engineering.

Follow-up activities include returning to campus for seminar presentations of student projects, community recognition for program participation, and continuous communication between the students and the University.

YOUNG SCHOLARS

J.Truman Stevens RCD 8850063
University of Kentucky FY88 $31,331
Lexington, KY Environmental

"Appalachian Students and the Earth Sciences"

The Appalachian Center of the University of Kentucky offers 20 junior-high students from this region laboratory, field and classroom experiences in a multidisciplinary setting. They study landforms and land use, water quality, forest management, and energy production and consumption, as they relate to mountain communities. The goal of the two-week residential program is to instill and maintain student interest and excitement about science and mathematics and to provide them with information on the preparation necessary to pursue a career in one of these disciplines.

COLLEGE SCIENCE INSTRUMENTATION

Robert L. Sauer USE 8852367
University of Kentucky FY88 $14,898
Hazard Community College Physics
Hazard, KY

"Integrating the Microcomputer in Student-Oriented Introductory Physics Laboratories"

The grantee will purchase a complement of scientific and computational equipment to improve instruction in Introductory Physics laboratory courses. The equipment, which includes air tracks, oscilloscopes, function generators, microcomputer interfaces, sensors, and motion transducers will allow students to obtain "hands-on" experience in the use of modern techniques for data acquisition and analysis. The improved speed and accuracy achievable with this equipment will allow students to explore a wide range of basic physical phenomena, and should help them gain greater understanding of the underlying physical principles.

The grantee will match this NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Lillie F. Crowley USE 8851488
University of Kentucky FY88 $28,983
Lexington Community College Mathematics
Lexington, KY

"Microcomputer Laboratory for Calculus Instruction"

A computer laboratory in the Department of Mathematics will facilitate the restructuring of the Calculus sequence. Computer assignments and writing of reports will be a main focus of the teaching strategy.

The grantee will match the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Darwin B. Dahl USE 8852664
Western Kentucky University FY88 $15,669
Bowling Green, KY Chemistry

"Acquisition of Spectrophotometric and Computer Interfacing Systems"

The grantee is seeking to improve the sophomore and junior level Chemistry laboratories. The development and implementation of modern experiments into the quantitative analysis laboratory is of immediate concern. To effectively grasp new methods and techniques used in the industry's increasingly computerized laboratories, it is necessary for the student to have "hands on" experience with computer-controlled instrumentation. Specifically a scanning uv-visible spectrophotometer and a fluorescence spectrophotometer, both interfaced to computers, are being added to expand the current level of experiments and data handling capabilities. In addition, an introduction to the interfacing of simple equipment such as pH meters and temperature probing devices is available to the student as a result of the computer's versatility.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Kenneth Mussnug USE 8852159
Western Kentucky University FY88 $23,978
Bowling Green, KY Mechanical Eng

"Enhancement of a Flexible Manufacturing System."

This project incorporates a programmable robot into this institution's flexible manufacturing laboratory. The robot, a GMF S100, permits curriculum enhancements in both the lower and upper divisions. In the lower division, courses on Contemporary Manufacturing Operations include topics requiring entry level programming of the robot. Upper division courses in Computer Aided Manufacturing and the senior Design course expose students to advanced device programming and operation. The upper division students utilize the programmable robot to produce products.

This award is being matched by an equal sum from the grantee.

LOUISIANA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Murray P. Pendarvis
Science
Doyle High School
Livingston, LA

Virginia Stallings-Roberts
Mathematics
Louisiana School for Math/Science/Arts
Natchitoches, LA

1988

Zoe S. Harrell
Mathematics
LA State U Laboratory School
Baton Rouge, LA

Claudia R. Fowler
Science
University Laboratory School
Baton Rouge, LA

INFORMAL SCIENCE EDUCATION

Dale Stastny	MDR 8751199
Steven Dorand	FY87 $185,915
Peter Shannon	Biology
Kevin Bowler	
Audubon Zoological Garden	
New Orleans, LA	

""Pathways to the Past" - A Discovery Center"

New Orleans' Audubon Zoological Garden will design and construct a 3,000 square foot exhibition "Pathways to the Past" that will utilize interactive exhibits to highlight the ancestral link between birds and reptiles and to explore the ensuing development of each species. The permanent exhibition, occupying a prominent place in the newly remodeled Odenheimer building, will be used both by 125,000 school children visiting the zoo each year and for the more than one million regular visitors. More than a third of the residents of New Orleans are minority group members.

Zoos are increasingly emphasizing their science communication and science education mission in the context of zoological research and species preservation. They have a substantial need for improved educational resources to better meet the needs of the large and broad cross section of their visitors. The Audubon Zoo's specific plans for interactive exhibits are well thought out, with many connections back to the living collection of the zoo. They have assembled an advisory committee and consulting team that includes scientists, zoologists, educators and science education specialists. They plan a variety of educational materials in support of the exhibition, and will communicate the results of the project to other zoos through reports, publications and presentations. More than $213,000 in direct matching support will be provided by private sources.

COLLEGE SCIENCE INSTRUMENTATION

Beth E. Leuck	USE 8851700
Centenary College of Louisiana	FY88 $6,753
Shreveport, LA	Biology

"Computer-Assisted Data Acquisition in Undergraduate Physiology Laboratories"

The goal of this project is to improve the quality of undergraduate laboratory experiences by equipping the organismal physiology laboratories with computer-assisted data acquisition apparati. Three courses in the Biology Department (General Zoology, Human Anatomy and Physiology, and Animal Physiology) will be directly affected.

Previously, physiological experimentation in the laboratory sections of these courses was limited by inadequate equipment. The acquisition of computers, printers and appropriate hardware-software packages greatly enhances the ability of students to gather and analyze data. Six Laser 128 computers with monitors and printers and four software packages (Physiogrip, Spirocomp, Experiments in Human Physiology and Physiographic) constitute the suite of new equipment. These programs allow both majors and non-majors to collect data with a minimum of frustration, and introduce undergraduates to sophisticated uses of computers in Biology.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

CAREER ACCESS OPPORTUNITIES

Laura F. Lemoine	USE 8850669
Carolyn C. Collins	FY88 $56,800
Louisiana State University	Mathematics
Baton Rouge, LA	

"Louisiana Middle School Mathematics Enhancement Program for Women and Minorities"

This model project is designed to increase the participation of women and minorities in Mathematics careers by providing special instructional and outreach activities for students in grades six and seven to encourage their enrollment in high school elective Mathematics courses. It is a two-year collaborative effort of Louisiana Tech University and Grambling State University serving the northern half of the State, and Louisiana State University and Dillard University serving the south-central metropolitan region. The project identifies women and minorities with potential in mathematics, provides enrichment programs to stimulate their interest in mathematics, and provides skills and methodology enhancement for middle school Mathematics teachers. The activities in the project include 5-session Mathematics Inservice Workshops for skill development of middle school teachers based on the concepts and strategies recommended by the Curriculum and Evaluation Standards for School Mathematics Report of the National Council of Teachers of Mathematics. The five sessions address topics identified as critical for readiness in algebra and geometry and explore the impact of mental set (verbal and nonverbal signals that encourage and discourage development in math). The sessions are conducted by a Louisiana NSF Presidential Award winning teacher of high school geometry (Mrs. Lynn Stallings-Roberts, 1987). A series of five Saturday morning enrichment programs are conducted for students identified as having talent in Mathematics. The opening session is designed for students, their parents, and participating teachers in which an overview of activities is presented. Succeeding session include telelearning sessions taught by award-winning teachers, programs to stimulate interest and excitement in mathematics, field trips, individual student projects, and a culminating end-of-the-year picnic. A special seminar to promote parental support is also held for parents.

YOUNG SCHOLARS

Marshall D. Sundberg
Louisiana State University
Baton Rouge, LA

RCD 8850283
FY88 $31,291
FY89 $31,291
Life Sciences

"NSF Young Scholars in Basic Sciences at Louisiana State University"

A seven-week summer program at Louisiana State University enables students entering the eleventh or twelfth grade: 1) to take short courses on science subjects; 2) to work in a faculty research laboratory; 3) to participate in discussions on science careers, science methodology and scientific ethics; and 4) to take weekend field trips to nearby scientific and industrial facilities. Six students are commuters and six reside in campus dormitories. (The residential students will be recruited nationwide.) The short courses in science take place in the mornings of the first three weeks of the program. Participation in faculty research projects start in the afternoons of the first three weeks, and continue full- time in the final four weeks. The twelve students are divided among the six departments of the College of Basic Sciences: Biochemistry, Botany, Chemistry, Microbiology, Physics and Astronomy, and Zoology and Physiology. The students are expected to develop a science project for submission to a science fair, junior academy of science, or Junior Science and Humanities Symposium. Follow-up activities center around reporting on progress in the science project (for all students), but also include classroom visits by staff members and a Saturday renewal session (for local students).

COLLEGE SCIENCE INSTRUMENTATION

James D. Goodrich
Louisiana State University
Shreveport, LA

USE 8851427
FY88 $14,242
Chemistry

"Improved Chemistry Instruction with UV-Visible Spectrophotometry"

The acquisition of nine spectrophotometers is providing modern, reliable instruments for first- through fourth-year Chemistry Laboratories. New and revised experiments using spectrophotometric techniques are being introduced at all levels. First year Chemistry Laboratory students are utilizing four spectrophotometers interfaced with microcomputers to acquire data from three experiments to quantify a chemical equilibrium constant, the percentage of manganese in steel, and a kinetics rate law expression. Nonscience curricula students in another laboratory course are spectrophotometrically determining the iron content of some common foods. Students in second year quantitative analysis are using four microprocessor controlled spectrophotometers also linked to a microcomputer to determine two metals in mixtures and phosphorous in blood serum. The students are also isolating and identifying lycopene and beta-carotene from tomatoes by using a scanning ultraviolet-visible spectrometer. Students in Organic Chemistry are being introduced to scanning uv-visible spectrophotometry in a study of the isomerization of an alkene. Upper division Chemistry curriculum students are using the same scanning uv- visible spectrophotometer to determine ligand field characteristics, stability constants, and identify compounds. The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Carolyn F. Talton
Mordessa Corbin
Merlene Lutes
Carolyn Palmer
Louisiana Tech University
Ruston, LA

TPE 8650097
FY87 $66,972
FY88 $92,117
Mathematics

"North Louisiana Mathematics Improvement Project"

The main goals of the project are to utilize the expertise of a cadre of fifteen master teachers and fifteen supervisors to be inservice directors in their local school systems during the academic year. These leaders are to eventually contribute to the inservice educational experiences of teachers at 60 satellite school sites in their respective systems and oversee the continuation of the professional development of the teachers in the local schools. The cadre provides leadership in the development of teaching materials designed to promote higher-order cognitive skills in students and assist in the identification of less well-prepared teachers who need to improve their skills in teaching mathematics. It is planned to develop partnerships between the schools and the target communities by devising ways to involve persons from the private sector in meaningful classroom activities. Also, there is to be parental involvement generated by the staff and the leadership cadre through a Parents Handbook which shows ways in which parents can extend the mathematics skills of their children.

In addition to the direct involvement of the 30 cadre leaders there will be secondary involvement of over 1000 teachers and parents receiving benefits to some degree from the project activities, and these teachers will in turn affect the mathematics learning of 164,898 students in an entire region of Louisiana.

COLLEGE SCIENCE INSTRUMENTATION

Mary M. Brazier USE 8750403
Loyola University in New Orleans FY87 $11,500
New Orleans, LA Psychology

"Computerized Laboratories in an Undergraduate Psychology Department"

The psychology department is upgrading equipment in existing laboratories in learning and perception, in a cognition course, and further promoting and broadening the opportunities for independent student research. The laboratories and research activities supported by this proposal are intended to illustrate the principles and concepts of psychology through first hand exposure, to familiarize students with the scientific methodology and instrumentation in these areas, and ultimately to develop the skills necessary for independent investigation. Six microcomputers, six printers, and two interfacing devices are being requested. Two computers, printers, and the interfaces will be used to support laboratories in learning and three computers and printers will be used in cognition and sensation/perception courses. The sixth computer and printer will be devoted to data analysis and preparation and report writing by students enrolled in the above courses and those carrying out a senior thesis.

COLLEGE SCIENCE INSTRUMENTATION

Joseph M. Richardson USE 8852893
McNeese State University FY88 $43,400
Lake Charles, LA Civil Eng

"Upgrading of the Universal Testing Machine for Undergraduate Civil and Mechanical Engineering"

This project replaces an antiquated screw-powered Universal Testing Machine (UTM) with a modern UTM that has a capacity of 400,000 lbs. in compression and 200,000 lbs. in tension. The UTM is hydraulically operated which offers more precise control that the mechanically operated screw type. This increased control makes it easier to control experiments and to improve accuracy when operating in the lower load ranges. The UTM is equipped with accessories which provide the Civil and Mechanical Engineering Departments the capability of testing concrete cylinders in compression, unthreaded rods and reinforcing bars, and flat bar specimens. A flat bed recorder is provided to make hard copy diagrams of stress versus strain for the materials tested. The new UTM is also used in demonstration in the Pre-Freshmen Engineering Program designed to attract minority high school students to the science and engineering fields.

This award is being matched by an equal sum from the grantee.

YOUNG SCHOLARS

Mary O. Richardson RCD 8850159
McNeese State University FY88 $35,557
Lake Charles, LA Engineering

"Young Scholars Program"

McNeese State University offers a two-year summer Young Scholars Program in the field of engineering for 20 academically high achieving black students who have completed the 8th or 9th grade. The program has three main components: "hands-on" engineering; counseling; and class work in geometry, trigonometry, and computer-aided design. This commuter program is held for eight weeks during the summer in the College of Engineering and Technology. During the "hands-on" portion, students will build a 24-foot diameter geodesic dome.

Classroom work is directly related to the two "hands-on" projects. Most of the instruction is computer directed, using teaching software for mathematics and the AutoCad program for drawing designs. Students are drawn from those who completed a Pre-Freshman Engineering Program (PREP) sponsored by the U.S. Department of Energy at McNeese State during the summer of 1987. The Young Scholars Program functions as a follow-up for the PREP program.

TEACHER ENHANCEMENT PROGRAM

Stearns W. Rogers Sandy Duke McNeese State University Lake Charles, LA	TPE 8652423 FY87 $93,845 Elem Science

"Leadership Program in Physical Sciences for Elementary Teachers and Principals"

This Teacher Enhancement project is designed to improve the quantity and the quality of elementary physical science education in the Calcasieu Parish schools of Louisiana. The project is comprised of two components. The first is a year-long workshop in concepts and activities designed to broaden and update the knowledge of physical science for 60 elementary teachers and 12 principals. The workshop will also foster the teaching of elementary science in an inquiry mode. The second component of the program is a series of eight in-service activities carried out by the teachers and principals in their particular schools, whereby they share with colleagues the knowledge and teaching expertise which the workshop provided. At the end of two years, there will be a teacher/teacher or teacher/principal team in each of the thirty-six elementary schools in the Parish which will provide both formal and informal leadership in the teaching of physical science. All principals in the Parish will also participate in an inservice program focused on the role of the principal as an instructional leader in the teaching of science.

Participants in the project will have ample opportunities to actively engage in science activities and develop and plan appropriate science lessons and units which are consistent with the curriculum in the Parish schools. Elementary science supervisors and college staff will assist the participants in both implementation of inquiry science within their classrooms and the development of the inservice programs for the staff. Videotaping facilities will be available to participants for self-evaluation of their classroom instruction and their inservice programs. The PI has developed a sound evaluation model to assess the impact of the project. The school districts, parent/teacher groups and McNeese State University are supporting the project beyond the funding provided through the NSF grant.

The PI and staff are eminently qualified to conduct this project, having been involved for some time in teacher enhancement activities in science education. An Advisory Committee comprised of representatives of the constituencies involved will provide direction to the project and assist in the assessment of its impact.

COLLEGE SCIENCE INSTRUMENTATION

Ibibia K. Dabipi Southern University A & M College Baton Rouge, LA	USE 8750565 FY87 $49,956 Electrical Eng

"An Undergraduate Digital Communications Laboratory Project"

Under this project, four Lab-Volt Model 8085 Digital Communications Training System will be used to upgrade the communication systems laboratory. Using this equipment, the students will be able to perform experiments in the areas of sampling, analog to digital conversion, spectral analysis of digital modulation schemes, signal to noise ratio, and bit error analysis of digital transmission systems and error correction code implementation. These experiments will enhance the learning of students in the digital communications area.

YOUNG SCHOLARS

Thomas L. Henderson Southern University A & M College Baton Rouge, LA	RCD 8850091 FY88 $40,000 FY89 $40,000 Engineering

"Engineering Summer Institute"

Southern University conducts two four-week summer residential institutes focused on orienting high potential minority high school students (grades 10-12) toward careers in engineering and the sciences. Participants receive intensive training in mathematics, chemistry, physics, computers, communications, and engineering science. Students perform design work which requires creative thinking and innovation in arriving at a novel solution to a design problem. Participants also visit area plant sites to experience the real world practice of engineering and to meet with minority scientists and engineers employed at those industries. The underlying premise of the program is to impart to the participants an understanding and an appreciation of the analytical thought process and activities of the scientist-engineer.

COLLEGE SCIENCE INSTRUMENTATION

Amitava Jana Southern University A & M College Baton Rouge, LA	USE 8853122 FY88 $23,882 Mechanical Eng

"Robotics Laboratory Project"

This project enhances this institution's offerings in the areas of manufacturing, computer-aided design/computer-aided manufacturing (CAD/CAM) and robotics. The equipment funded by this award supports undergraduate Mechanical Engineering courses at the sophomore/junior level as well as advanced courses at the senior level. In particular, students learn both theoretical and practical aspects of: teach pendant control, computer interfacing, mechanical manipulation, off-line programming and simulation, and application of computer vision. The laboratory equipment includes: Rhino robots with tilt rotary carousel, belt conveyor, x-y table, software and other accessories, and, a computer vision system. Student interface is via IBM PC's.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

John F. Cawley TPE 8652335
James H. Miller FY87 $85,835
Mary B. Seay Mathematics
University of New Orleans
New Orleans, LA

"Science and Mathematics for Handicapped"

The general purpose of this project is to conduct a pilot study of the impact of regular education teachers on the performance of mildly handicapped children in science, mathematics and computer program development. A ten-day staff development program will provide twelve regular education elementary teachers with the skills necessary to conduct the implementation of instruction in science, mathematics and computer program usage at two schools. After training, the regular classroom teachers, both the project participants and a control group of teachers, will work with children in both small and large groups under observation. Comprehensive evaluation of pupil performance and teacher performance and activity will be evaluated for both curriculum and instruction. The Project Director seeks to improve on the existing curriculum, rather than create a new one. The successful outcomes of this project will be disseminated to help meet the needs of the nearly 3,000,000 mildly handicapped children in regular grades and the school personnel who serve them.

MAINE

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

David Heckman
Mathematics
Monmouth Academy
Monmouth, ME

Richard C. Weirich
Science
South Portland High School
South Portland, ME

1988

Claire Letellier
Mathematics
Yarmouth High School
Yarmouth, ME

Joan T. D'Agostino
Science
Mount Desert Island High School
Mount Desert, ME

COLLEGE SCIENCE INSTRUMENTATION

James G. Boyles USE 8851648
Bates College FY88 $10,576
Lewiston, ME Chemistry

"Computer Interfacing for Laboratory Data Acquisition and Analysis"

The questions being asked by today's scientists are moving them steadily into realms where rapid acquisition of data is commonplace, and where sophisticated and detailed analysis is required to make these data sensible. Exposure to the uses and applications of the tools required to engage in this work is becoming an increasing necessity in the undergraduate preparation of young scientists. The microcomputer with its potential for interfacing to instruments and apparatus is a central tool in this process. It is the aim of this project to provide, for Chemistry majors, meaningful instruction in and experience with computer interfacing in laboratory environments. Six computer interfacing units are being purchased to be used in six different laboratory courses distributed over the last three undergraduate years. The project is providing an early introduction to computer interfacing, with units appropriately configured for use by inexperienced students. Uses and applications are building in sophistication as students move into more advanced laboratory situations. Chemistry majors are engaging in multiple experiences with these tools and techniques, and it is estimated that seventy new students per year are being exposed to the techniques.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Laura G. Malloy
Bates College
Lewiston, ME
USE 8750377
FY87 $30,192
Biology

"Equipment to Teach Microprocessor Analysis of Video and Analog Signals in an Undergraduate Physiology Laboratory"

This project is improving the undergraduate program in experimental Physiology by introducing the use of video equipment and computer interface devices for data acquisition and analysis. Students are being exposed to three current methodologies: a video-image analysis system, an analog-digital converter system, and an x-y digitizing tablet. Microprocessors are being used to analyze the output from the three systems.

The equipment is making it possible to introduce strikingly new laboratory exercises that improve both the accuracy and efficiency of data acquisition and analysis, and that give undergraduates hands-on experience with highly current research and analytical skills. The project is impacting students in eleven courses and in independent student research covering three subdisciplines: Animal Physiology, Plant Physiology, and Physiological Psychology.

COLLEGE SCIENCE INSTRUMENTATION

Georgia N. Nigro
Drake R. Bradley
Bates College
Lewiston, ME
USE 8852194
FY88 $44,287
Psychology

"Networking the Classroom and Microcomputer Laboratory to Enhance Undergraduate Training in Psychology"

This project makes microcomputer technology a central part of the undergraduate experience in Psychology. It establishes an interactive classroom and two computer laboratories. The interactive classroom is equipped with a microcomputer, a video recorder, and a multi-sync video projection system for effective in-class demonstrations of microcomputer applications. The statistics laboratory enables the conduct of laboratory assignments requiring data analysis and simulation, and the on line laboratory permits the on line control of experiments. The classroom and laboratory microcomputers are networked in order to provide the advantages of a mainframe system without the corresponding limitations.

Undergraduates are involved in all phases of the use of microcomputer technology in research, data acquisition, on line experimental control, data retrieval, data analysis, bibliographic work, report writing, graph making, and simulation. Student proficiency in using microcomputers is a means to deeper understanding of basic psychological principals as well as an end in itself.

The award will be matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

John E. Smedley
Bates College
Lewiston, ME
USE 8851997
FY88 $13,515
Physics

"Microcomputer-based Undergraduate Experiments in Laser Spectroscopy and Atomic Collision Phenomena"

Exposure to modern instrumentation and techniques are essential to the development of today's Physics major and tomorrow's physicist. The Physics Department will introduce new, microcomputer-interactive experiments in laser spectroscopy and atomic collision phenomena into the laboratory program. Development of the proposed experiments will involve advanced students in independent study and senior thesis projects. Ultimately the apparatus will be used in the sophomore level Laboratory Physics course, which is required of all Physics majors.

The award will be matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Thomas J. Wenzel
Bates College
Lewiston, ME
USE 8750027
FY87 $27,710
Chemistry

"Gas Chromatograph Mass Spectrometer for Undergraduate Instruction"

A gas chromatograph/mass spectrometer (GC/MS) is being used by the Chemistry Department at Bates College for undergraduate instruction beginning in the sophomore year with organic chemistry and continuing in varying degrees in five upper-level chemistry courses. The specific applications of GC/MS in these courses has been designed to be similar to those encountered by industrial chemists or by students undertaking graduate study.

COLLEGE SCIENCE INSTRUMENTATION

Eric R. Wollman	USE 8750084
Bates College	FY87 $23,441
Lewiston, ME	Physics

"Development of the Laboratory for Non-Majors"

A simple but sophisticated laboratory equipped with good instruments is an essential component of physical science education for students majoring in the humanities and the social sciences. Bates College will add instruments to the physics and astronomy laboratory for non-majors which will substantially improve the laboratory experience. The instruments consist of telescopes which will collect light for photometers and spectrometers through a fiber-optics system, as well as equipment to measure the properties of photons and electrons. The instruments will allow students to make a wide variety of measurements of the quality of light radiated by laboratory and astronomical sources and to conduct key experiments relevant to the particle-wave nature of light and matter.

FACULTY ENHANCEMENT PROGRAM

Dana W. Mayo	USE 8854166
Bowdoin College	FY88 $30,000
Brunswick, ME	Chemistry

"Summer Institute Microscale Organic Laboratory Techniques"

The Summer Institute on Microscale Organic Undergraduate Laboratory Techniques is designed to assist 30 faculty who will undertake this type of laboratory approach by introducing them to the experimental methods involved. The one-week institute is organized around a framework of lecture-demonstrations, laboratory exercises and informal group discussions of microscale techniques. Laboratory experience will be emphasized, with particular attention paid to manipulative procedures involved in preparation, isolation, purification and characterization of reaction products at the milligram level.

In addition to the NSF funds, participants' institutions will contribute about 25% in travel costs to the operation of the project. The grantee institution will contribute another 5%.

COLLEGE SCIENCE INSTRUMENTATION

William L. Steinhart	USE 8750285
Bowdoin College	FY87 $50,000
Brunswick, ME	Biology

"A Scanning Electron Microscope for Undergraduate Biology Instruction and Student Research"

Technical advances in the design and current applications of the Scanning Electron Microscope (SEM) are making it increasingly desirable for undergraduate Biology majors to gain experience in using it. The recent arrival of two new faculty members with expertise in SEM technology have made this a propitious time for the Department to develop two new courses, Electron Microscopy and Advanced Developmental Biology. Both of these use scanning electron microscopy as a primary technique. In addition, the SEM will be used for demonstrations in the Introductory Biology, Developmental Biology (core) and Botany courses, providing an introduction to the instrument for all students taking courses in this Department.

This faculty successfully employed a SEM in the instructional program until the demise of their former instrument several years ago. The old SEM had featured prominently in student research projects. Based on their educational experience with the earlier, somewhat primitive instrument, they now have selected a modern, more adaptable instrument -- the Zeiss DSM 950. The virtues of this instrument include its ease of operation for students and its digitalized design which allows integration into existing computer facilities, providing enhanced capability for automating analyses. The Department already possessed the requisite ancillary equipment such as coating devices, critical-point drying apparatus and computer facilities. Thus funds were needed only for the SEM itself. A substantial contribution from the Hilden Trust, when added to the College matching funds, has provided a substantial overmatch to the Federal grant for this project.

COLLEGE SCIENCE INSTRUMENTATION

Paul G. Greenwood	USE 8852191
Colby College	FY88 $33,475
Waterville, ME	Biology

"Fluorescence Microscopy for Undergraduate Teaching and Student Research"

The fluorescence microscope has become an essential tool in many areas of research in the biological sciences. The localization of a variety of cellular structures using specific fluorescent markers or immunofluorescence is essential to much of our current understanding of such basic concepts as the cytoskeleton, cellular motility, and cellular transport phenomena. The aim of this project is to integrate fluorescence microscopy into the biological curriculum. A state-of-the-art microscope with capabilities for automatic photomicrography and for phase-contrast, differential interference-contrast, and incident- light fluorescence microscopy (in concert with video monitors and cameras and with additional microscopes with appropriate capabilities) is being used in the laboratories of several courses.

The major application is in a new course in Cellular Dynamics where fluorescence microscopy enables undergraduates to investigate the regulation of a variety of cytoskeleton-mediated events and receptor- mediated endocytosis. Additional applications are in the teaching laboratories associated with courses in Animal Cells, Tissues, and Organs, in Microbiology, Topics in Molecular Biology, and Genetics. These applications make it possible for the faculty to stress the integration of biological principles over a broad spectrum of courses. Thus the project provides students with the unique opportunity to learn many of the applications of fluorescence microscopy through experimentation in a variety of laboratories.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

FACULTY ENHANCEMENT

Donald B. Small
Colby College
Waterville, ME

USE 8854266
FY88 $192,024
Computer Science

"Computer Algebra Systems Workshops"

The advent of powerful microcomputers and the development of Computer Algebra Systems (CASs) has set mathematics on a revolutionary course, providing the potential for one of the most important and beneficial changes in undergraduate mathematics curricula in decades. Despite the importance of CASs, most undergraduate mathematics teachers have little or no experience with computers as a teaching tool. There is a need for "hands-on" introductions to CAS to prepare teachers to use CASs in their classroom, and to seed new initiatives. A number of Colleges, Colby among them, have been experimenting in the use of CASs through the help of grants from the Alfred P. Sloan Foundation. The project director of the present program, in conjunction with an Advisory Group of experts, will design and offer an intensive series of ten two-day workshops and five extended five-day summer workshops. Using CAS as a teaching tool requires restructuring the calculus curriculum in terms of both content and topic emphasis. Thus, the primary result of this program will be curriculum development. It is anticipated that out of this workshop series 200 teachers will be introduced to CAS at a serious level; 125 will gain experience in developing a calculus CAS curriculum and be prepared to use CASs in their courses; 15-20 people will become experienced CAS workshop instructors and consultants; 325 teachers will receive current CAS curriculum materials; 340 teachers will be involved in several hours of curriculum discussion and development; and a network of several hundred CAS users will be established. The project will plan and present the workshops at institutions around the country, and it will significantly influence the further development and implementation of a major reform in the teaching of mathematics.

In addition to grant funds, participants' institutions will provide an additional 30% in travel expenses.

COLLEGE SCIENCE INSTRUMENTATION

John G. Anderson
College of the Atlantic
Bar Harbor, ME

USE 8852860
FY88 $6,385
Civil Eng

"A Geographic Information System (GIS) for Teaching Environmental Science to Undergraduates"

This project is establishing a Geographic Information System (GIS) teaching facility that permits students to learn fundamental principles of computerized cartography and spatial data analysis. GIS products including specialized maps and overlays are being used in a variety of classes and teaching situations, both as examples of computer applications and as specific aids in courses in Biogeography and Applied Ecology.

The proposal includes funding for both software and hardware needed in creating and maintaining a geographic database for Mt. Desert Island and its immediate surroundings. Students select specific regions of the island and by digitizing a series of maps containing data ranging from hydrology to current land-use patterns, create a comprehensive picture of the island's biogeography. As the project develops, increasing areas will be covered and the resulting digital model will be available to both the academic and general community as an aid in planning, resource use, and development. The project provides students a unique opportunity to interact with and to learn to apply state-of-the-art cartographic techniques.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

YOUNG SCHOLARS

Donald W. Bailey
Jackson Laboratory
Bar Harbor, ME

RCD 8850263
FY88 $66,116
Life Sciences

"Summer Student Program"

Twelve high school juniors conduct independent research projects as apprentices for eight weeks in the summer under the direct supervision of members of the Jackson Laboratory's scientific staff. Working in their sponsors' laboratories, the students conduct projects that involve original research within the scope of their respective sponsors' ongoing research programs. The students gain experience in all aspects of research, including designing a project, implementing the research plan, interpreting data, and reporting the research results both orally and in writing. The students' research participation experience is supplemented with meetings of their respective laboratory groups and after-dinner research presentations and discussions by sponsors and students.

TEACHER ENHANCEMENT PROGRAM

Charles E. Hewett	TPE 8652005
Dean B. Bennett	FY87 $84,249
Leslie J. Hudson	FY88 $94,267
Maine Audubon Society	Environmental
Falmouth, ME	

"Maine School Science and Natural History Enrichment Project"

This two-year project of the Maine Audubon Society will develop 320 Master Science Teachers in order to improve science teaching and learning in elementary and secondary schools across Maine.

Through eight local workshops followed by one-on-one consultations with the project staff, assisted by teacher/volunteer teams drawn from the pilot year already completed, the participants will learn to develop and incorporate inquiry-based learning activities in physical, earth, life and ecological science into the curriculum.

In the first year, 160 science teachers identified as promising by their administrators in sixteen school districts will be provided with new instructional materials in the form of SCIENCE AND NATURAL HISTORY: A MAINE STUDIES SOURCEBOOK, produced by the Main Audubon Society. Each teacher will team with a volunteer who will assist in every aspect of teaching this material throughout the year.

In the second year these 160 teacher/volunteer teams will begin to train their peers and strengthen their schools' curricula. By the end of the academic year, 320 teachers will be qualified to extend the network to neighboring towns. The SOURCEBOOK, developed with the advice of teachers, principals, scientists, Audubon members, and the faculty of the associated College and University will be refined by the staff and teacher/volunteer teams.

Teachers will be eligible for either 3.5 or 5 recertification credits. They can also apply the time spent in workshops to the requirements of a three-credit graduate course on curriculum development they may elect at the University of Maine, Farmington.

Judith P. Swazey	BBS 8711082
Rosemary A. Chalk	FY87 $47,572
The Acadia Institute	Ethics
Bar Harbor, ME	

"Professional Values and Ethical Issues in the Education of Scientists and Engineers"

Education in science and engineering fosters personal and professional values as well as technical knowledge and skills. Traditionally, the former kind of educational experience has been more implicit than explicit. Recently, questions have arisen about the moral content of professional training and conduct, and about how value conflicts affecting professional training ought to be resolved. Co-sponsored by the Committee on Scientific Freedom and Responsibility of the American Association for the Advancement of Science, the Council of Graduate Schools in the U.S., and Sigma Xi's Committee on Science and Society, this project will compile and provide an assessment of current knowledge about policies and practices that affect professional values in graduate education in science and undergraduate and professional education in engineering. Working papers on the topics of academic guidelines, research sponsorship, misconduct, and ethics in engineering education will be prepared. Plans and pretests for a survey of students and faculty, to identify how socialization occurs and knowledge of institutional policies and procedures on these matters, will be developed. In addition, project staff will solicit, devise, and pretest scenarios of cases in which ethical or value issues for students and faculty have arisen. Besides identifying the issues and developing a plan for further study of them, the project will establish contacts with investigators and organizations with related interests. Results from the project will include an initial "state of the art" assessment of relevant literature and practice and the identification of related programs. Several from the series of working papers should merit publication. Finally, the co-sponsors will develop a comprehensive plan for further work.

This project will define the substantive issues and appropriate methodologies to investigate normative components in science and engineering education. The investigative team and consultants are very well qualified to undertake the project, and the institutional co-sponsors are most appropriate. Results are likely to be revealing, useful, and widely disseminated. The research design is very appropriate for this exploratory phase, and costs are reasonable.

This project is funded jointly with the Directorate for Biological, Behavioral, and Social Sciences.

COLLEGE SCIENCE INSTRUMENTATION

Ali Akbari	USE 8851421
University of Maine Fort Kent	FY88 $48,750
Fort Kent, ME	Biology

"Undergraduate Laboratory Equipment for an Environmental Monitoring Technology Program"

The project's aim is the development of a new technical curriculum in environmental monitoring using state-of-the-art methods and technologies. Included in the equipment provided through this award are a gas chromatograph/mass spectrometer (GC/MS), a separate GC, a high performance liquid chromatograph (HPLC), an atomic absorption spectrometer (AA), and a modern, computer-linked weather station. With the help of this equipment, students learn the procedures and principles involved in analyzing indoor and outdoor air, water, soil, and animal and human tissue for the presence of environmental contaminants resulting from agricultural and forestry pesticides, hazardous wastes, and industrial emissions. The resulting new curriculum, backed by the institution's excellent computer facilities, gives a technical focus to the existing B.S. in Environmental Studies Program and makes possible the institution of a new A.A. degree program in Environmental Monitoring Technology.

The project addresses the Nation's growing need for competent pollution and hazardous substances control technicians, provides skilled manpower for Northern Maine's environmental laboratories, and affords opportunities for upward mobility to the economically depressed predominantly French-American (Acadian) people of the St. John Valley in Northern Maine which the institution serves.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Peter Sereico	USE 8750719
University of New England	FY87 $11,911
Biddeford, ME	Ecology

"Experiments in Receiving Water Analysis"

As a part of an Environmental Analysis major a new laboratory course is being developed in "Receiving Water Analysis." Experiments are being developed and tested involving measuring the amount of dissolved oxygen in different situations and to evaluate parameters such as, reaeration constants, decomposition constants, and diffusion and dispersion constants. The Ion Chromatograph is being used to monitor inorganic ions such as nitrates and phosphates to evaluate empirical constants for use in classical water quality mathematical models. A laboratory manual for the course is being planned to indicate the possibilities these experiments provide for students in environmental studies.

MARYLAND

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Jahn W. Buhrman
Mathematics
Westminster High School
Westminster, MD

Janet M. Owens
Science
Catoctin High School
Thurmont, MD

1988

Martha E. Meadows
Mathematics
Frederick High School
Frederick, MD

William R. Harrington
Science
Bowie High School
Bowie, MD

TEACHER ENHANCEMENT PROGRAM

John W. Layman	
Jack M. Wilson	TPE 8751236
American Assoc of Physics Teachers	FY87 $587,605
College Park, MD	Physics

"Leadership Development of Physics Teaching Resource Agents"

This project will train a final corps of 50 Physics Teaching Resource Agents (PTRAs) bringing the total number of PTRAs to 300 throughout the nation. These 50 teachers will be trained in a three-week workshop in Bozeman, MT during the summer of 1987. The workshop will focus on contemporary content in physics, classroom strategies, laboratory techniques, and the incorporation of technology in physics instruction. The workshop will also focus on the skills required for the PTRAs to conduct effective inservice programs for their peers on a regional and local level during the 1987-88 academic year.

The project staff will provide substantial follow-up support to the PTRAs in the development and implementation of these inservice activities. Modest funding is also provided in the project for materials and supplies needed by both present and former PTRAs in carrying out the inservice programs.

The PTRAs will meet for the purposes of evaluation, follow-up and continued professional development at the next 4 AAPT regional and national conventions. The project also includes funds to carry out an extensive evaluation of the program since its inception. Cost-sharing by AAPT, the University of Maryland, Ohio State University, Montana State University, and local school districts will provide approximately 50% of the total project costs.

NETWORKS PROGRAM

Jack M. Wilson TPE 8651546
American Assoc Physics Teachers FY86 $68,600
College Park, MD FY88 $13,680
Physics

"Inter-American Conference on Physics Education"

This FY88 supplemental award is for the production of a manuscript on educational networks in physics, based on the findings of the Oaxtepec Inter-American Conference on Physics Education. This document and an extended bulletin on network activities and possibilities deriving from the Oaxtepec Conference will be distributed to key persons in this country and abroad to stimulate the formation of cooperative projects in physics education.

COLLEGE SCIENCE INSTRUMENTATION

Harry Harrison USE 8750313
Capitol Institute of Technology FY87 $37,991
Laurel, MD Electrical Eng

"An Undergraduate Network and Distributed Processing Laboratory"

Students majoring in electronics, computer and telecommunications engineering technology will be provided with expertise in the concepts of local area networks and distributed processing. In addition, courses in computer graphics and computer-aided design will be significantly broadened and enhanced. The need to become proficient in these areas is acute, particularly as the technology continues to move from large mainframes to the use of PCs. The project involves purchasing 16 Tandy 3000 HD PCs with the XENIX operating system, 16 ViaNet systems, two printers and an AutoCAD software package. They will be connected into a local area network and tied to a VAX 11/750 which will be used as the file server. Special projects will be arranged for students interested in additional knowledge in local area networks.

COLLEGE SCIENCE INSTRUMENTATION

Darcy Williams USE 8852474
Cecil Community College FY88 $32,127
North East, MD Chemistry

"Instrumentation for a Two-Year Chemistry Laboratory Technician Program"

The primary aim of the project is to improve the quality of a new and innovative Chemistry Laboratory Technician Program through the acquisition of a UV-Visible Diode Array Spectrometer, Gas Chromatograph, Liquid Chromatograph, Refractometer, and pH meters, as well as computer interfacing equipment. The instruments are also being used in Chemistry courses taught to students who intend to transfer to four-year colleges.

Due to the working partnership created between the college and the chemical industry in developing and running the program, both are sharing the responsibility for contributing and/or purchasing equipment as a match to the project.

The grantee is matching the award from non-Federal sources.

YOUNG SCHOLARS

Andrea R. Bowden RCD 8850276
Maria K. Kirk FY88 $65,640
College of Notre Dame of Maryland FY89 $65,640
Baltimore, MD Other NEC

"SANDALS-TEAMS: Summer at Notre Dame: Academic and Leadership Skills--Technology, Engineering and Mathematics and Science"

In SANDALS-TEAMS, thirty minority women entering their senior year in Baltimore City Public Schools sample college life in a supportive atmosphere during a five-week, residential program. They explore four fields of science, examine ethical issues, learn mathematics, improve study and communication skills and have field trips in the arts and sciences.

The academic component of SANDALS-TEAMS consists of week-long mini-courses in biology, earth sciences, chemistry and physics in which students engage in laboratory activities utilizing instruments not available in high school. The mathematics courses focus on skills needed in each of the sciences. In Special Topics, ethical issues related to each science are explored. A college-level English course has a writing support class. Workshops in College Survival Skills, Study Skills and Personal Development provide guidance and strategies for personal success. Field/career experiences in the sciences, cultural events, and the highlighting of the achievements of women and minorities expand students' horizons.

COLLEGE SCIENCE INSTRUMENTATION

Esther J. Gibbs
Goucher College
Towson, MD
USE 8750765
FY87 $22,107
Ecology

"An Atomic Absorption Spectrometer for Undergraduate Environmental Studies in Biology and Chemistry"

Goucher College will buy an atomic absorption spectrometer (AA). The AA will be used in a variety of upper level chemistry and biology courses, and it will also be the major piece of equipment used in six week intensive projects, where chemistry and biology students join forces to investigate the uptake of heavy metals in aquatic organisms. This project will simulate the interaction of biologists and chemists typical of research or industrial settings and will require both independence and communications skills. This project may serve as a model for cooperative teaching between disciplines where shared expertise is focused on different aspects of the same question.

After receiving background in toxicology and instrumental analysis respectively, the biology and chemistry students will join forces. Biology students will formulate the basic questions about metal uptake and toxicity and then consult their chemist peers to develop the experimental design and analytical protocol for metal analysis in tissues using the AA. The biology and chemistry students will then analyze the samples and interpret the data together. This is an excellent place for students to experience the benefits of modern computer interfaced instrumentation, for it will greatly affect their ability to answer scientific questions. The sensitivity of the AA will permit detection of trace levels of metals in the environment or in tissues. Sample automation will allow enough samples for thorough data analysis, which will in turn be greatly facilitated by the onboard graphics and data management software of the AA.

INFORMAL SCIENCE EDUCATION

Phyllis Katz
Hands-on-Science Outreach Inc
Rockville, MD
MDR 8744759
FY85 $82,590
FY86 $76,488
FY87 $95,157
Elem Science

"Piloting and Seeding the Hands-On-Science Afterschool Enrichment Program"

There is significant value in early out-of-school activities that help provide direct experience with natural phenomena and concepts that contribute to success in more formal science study. Much like supplementary classes in music and art, the "Hands-On-Science" Program of Montgomery County, Maryland (a program of the local Council of PTAs) provides an after school enrichment program of recreational science activities which are playful and encourage children to see science in their every day world.

In this project, HOSO will explore the possibility of establishing pilot projects in other communities--training teachers and volunteers, providing materials, and testing the strength of this model in other communities. The program is completely self-funded in its present location. Choice of projected locations are based upon enthusiastic interest at PTA and science teacher meetings as well as selecting demographically varied sites.

INFORMAL SCIENCE EDUCATION

Phyllis Katz
Janet Frekko
Hands-on-Science Outreach Inc
Rockville, MD
MDR 8850342
FY88 $148,929
Elem Science

"An Afterschool Option - The Hands on Science Outreach Program - Part II"

The Hands-On-Science Outreach (HOSO) program, with support from NSF, has established more than 15 sites across the country where it operates after-school science enrichment classes taught by local community resource staff using materials and training provided by HOSO. With steady growth, these outreach sites have over three years reached more than 10,000 children with multi-session science programs. In the 1987-88 school year 681 classes at 15 sites were offered, while the parent Hands-On-Science (HOS) program in Montgomery County, Md provided 532 classes.

HOSO will extend the results of the first three years, establish new sites, strengthen existing ones and develop an overall plan for economic self-sufficiency. Additional curriculum materials will be developed, manufacturing and distribution methods will be improved, and experiments with more cost-effective teacher training implemented. Planning options will include whether to emphasize centrally-managed and operated program sites, or to expand the model of local "franchises" that operate independently, but are supported by HOSO as an initiator, developer and supplier of materials and training. Other project support from user fees and private grants will total more than $300,000.

NETWORKS PROGRAM

John H. Falk
Howard County Chamber of Commerce
Columbia, MD
TPE 8550580
FY86 $79,924
FY87 $79,924
Other NEC

"Community Science Project"

The Community Science Project is an effort to improve science education by broadening the participation of community elements in the educational process. Parents, business-industry, Chambers of Commerce, museum (and related institutions), professional and trade associations, universities, community colleges, and trade and technical schools need to expand their involvement in the total educational process, and work out strategies for sharing science education obligations and benefits. Because the resources are already in place, the project hopes to demonstrate how major changes can be effected without necessitating significant increases in educational costs. In a stepwise fashion, the project will implement and document a self-sustaining model for broadening educational representation and participation; exploiting underutilized community resources; encouraging two-way, non-altruistic interactions; and upgrading community awareness, knowledge, capabilities and attitudes in science/society/technology areas.

The plan involves identifying sectors/organizations within Howard County that could or should be involved with science education. These groups will be contacted and their potential contributions to science education, and any needs they have that schools or other community sectors could satisfy, will be identified and documented. Needs and contributions will be matched and the Principal Investigator will arrange meetings between relevant groups, facilitate interactions, and provide technical assistance where necessary. Follow-up meetings with all sectors/organizations will be arranged to determine what they have done in science education, and needs and resources lists will again be generated. The overall process of developing lists of needs and resources, matching lists, and facilitating the resulting community interactions will be continued. The program will be expanded in a stepwise fashion and will involve a grassroots effort. The staff, working out of the Howard County Chamber of Commerce, will be responsible for identifying and recruiting experts in the community, utilizing their expertise in the most cost-effective manner, documenting meticulously the interactions established, and assisting the county to develop its own strategies for maintaining the program without external funding.

STUDIES AND ANALYSES

Henry J. Becker	OSPA 8850564
Nancy L. Karweit	FY88 $240,000
Johns Hopkins University	FY89 $123,438
Baltimore, MD	Studies

"United States Participation in the IEA Computers-in-Education Study"

This project supports United States participation in the 1989 international survey of computer use in elementary and secondary education, organized by the International Association for the Evaluation of Educational Achievement (I.E.A.). In the United States, data about schools' instructional uses of computers, particularly in mathematics, science, computer studies, and the English language, will be obtained by survey methods from principals and teachers in 1,800 schools. This data, combined with similar data collected in 1983 and 1985, will be used to document changes in teachers' and principals' actions and beliefs about the applicability of computers to instruction in mathematics , science, computer studies, and other fields. Because all 18 participating countries will be employing nearly identical survey instruments and similar sampling practices, international comparisons will also be made with these data.

This project also includes a policy analysis of the effects of state policies and approaches towards school technology on actual school practice, by combining detailed inquiry into state-level actions with school-level survey data, the survey sample having been substantially supplemented in six states selected to provide a wide cross-section of demographic environments and approaches to technology by state governments.

TEACHER ENHANCEMENT PROGRAM

Mary B. Hyman	TPE 8550052
Peter Yancone	FY85 $136,810
Maryland Academy of Sciences	FY87 $ 1,250
Baltimore, MD	Physics

"Workshops to Train Teachers in the Instruction of Gifted and Talented Students in Science and Math"

The Maryland Academy of Sciences will be able to increase the number of teacher participants in its teacher development workshop which is coordinated with current programs for gifted and talented students. Participants work with and without students enabling their skills and content expertise to be practiced immediately in a classroom setting.

These highly successful workshops are conducted by Mary B. Hyman, Director of Education at the Maryland Academy of Sciences/Maryland Science Centers.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Frank J. Batavick	MDR 8651559
Helenmarie Hofman	FY86 $ 97,710
Maryland State Dept of Education	FY87 $320,820
Baltimore, MD	FY88 $485,404
	FY89 $450,000
	Physics

"A Science-Based Video Series for Young Children"

This is a continuing award for a project designed to produce a video series for young children of preschool and early elementary years. The Maryland State Department of Education is cooperating with the National Science Teachers Association to identify topics for 15 video programs and related printed materials. The series will explore everyday events in the lives of young children and integrate science and mathematics concepts, skills and applications into a variety of curricular areas.

Early childhood is an extremely important time to acquaint students with solid but interesting concepts in the sciences. In addition,more and more children are attending preschool sessions, an area for which these series are targeted. The Instructional Television component of the Maryland State Department of Education has an impressive track record in the production of educational video. We can only expect that this award will result in an important contribution to early education in the sciences and mathematics.

COLLEGE SCIENCE INSTRUMENTATION

Peter H. Anderson
Morgan State University
Baltimore, MD

USE 8750327
FY87 $50,000
Electrical Eng

"Enhancement of an Undergraduate, General Purpose Interface Bus (GPIB) Controlled Electrical Engineering Laboratory"

The School of Engineering at Morgan State University will enhance its undergraduate, lower-level, electrical engineering laboratories by the addition of GPIB instrumentation. This will enable the student to either manually control an experiment or to develop a computer program to control the instrumentation and take measurements with a computer. The computer control will also allow the student to reconfigure the circuit under test rapidly, analyze the data with the full power of the computer, and finally, display the data on a digital oscilloscope.

COLLEGE SCIENCE INSTRUMENTATION

Peter H. Anderson
Morgan State University
Baltimore, MD

USE 8852176
FY88 $15,551
Electrical Eng

"Digital Circuits Laboratory"

This project widens the scope of this institution's Digital Electronics course sequence by including the ability to customize advanced architecture logic circuits and by exposing students to logic analyzers for debugging and troubleshooting complex digital circuits.

This project is supported by a laboratory which includes programmable Logic Workstations running Altera development software and HP Logic Analyzers. This collection of hardware and software permits students to design and simulate a circuit, using a computer, prior to constructing the circuit.

This award is being matched by an equal sum from the grantee.

INFORMAL SCIENCE EDUCATION

Paula Schaedlich
David M. Pittenger
National Aquarium in Baltimore
Baltimore, MD

MDR 8751435
FY88 $280,916
Biol Ocean

"Whales: Interactive Exhibits at the National Aquarium in Baltimore"

The National Aquarium in Baltimore will create 20 interactive interpretive exhibits relating to cetaceans as an integral part of a new Marine Mammal complex opening in 1989. Exhibits will complement cetacean behavior demonstrations conducted by mammalogists in a 1300-seat marine amphitheater. Exhibit topics and content will be developed in response to survey and evaluation data on popular interests and misconceptions about marine mammals by a design team consisting of aquarium staff, educators, marine scientists, designers, and evaluators. The resulting interactive exhibits will be seen by one and a half million visitors a year in an exhibit area adjacent to the marine amphitheater where visitors will gather prior to and after scheduled demonstrations. NSF project support will be matched by an equal contribution from the National Aquarium.

APPLICATIONS OF ADVANCED TECHNOLOGY

Burton H. Colvin
National Bureau of Standards
Gaithersburg, MD

MDR 8751278
FY87 $28,752
Services

"Invitational Seminar for Computer Science, Mathematics, and Science Faculty of Minority Institutions"

This seminar series is a continuation of the National Science Foundation and National Bureau of Standards outreach program for technology in science and mathematics for faculty of minority institutions. Two, four-day, seminars will be held (each seminar will consist of two days at NSF and two days at NSB).

The meetings will provide an opportunity for NSF of acquaint approximately 60 faculty members from 30-40 minority institutions with relevant NSF programs and NSF in general. It also provides an opportunity for NSF program officers to meet key people at minority institutions who can facilitate the identification of potential reviewers and who can identify minority researchers and encourage their participation in NSF programs.

The strengths of the proposal are that (1) evaluations of prior meetings have judged them useful and the evaluation of the recent joint seminar found that the opportunity to learn about NSF programs was judged very important to the faculty who attended, (2) joint sponsorship will significantly reduce the costs for both sponsoring agencies, (3) this form of activity moves beyond passive approaches of individual programs and acts as a catalyst for personnel at both the Foundation and the participating institutions.

COLLEGE SCIENCE INSTRUMENTATION

Allan K. Hovland	USE 8852439
St Mary's College of Maryland	FY88 $34,837
Saint Marys City, MD	Chemistry

"Enhancing Instruction with NMR Spectrometry"

A Varian EM-360L Nuclear Magnetic Resonance Spectrometer equipped with a variable temperature probe and lock/spin decoupler is enabling the College to achieve a major curricular goal in its Chemistry program. The opportunity for students to gain hands-on experience with instrumentation that plays a fundamental role in the modern chemistry laboratory is being achieved. The NMR is being incorporated into laboratory work in Organic, Physical, and Inorganic Chemistry courses. Laboratories are being enhanced with more rigorous and instructionally richer experiments. Student research quality is being markedly improved with the improved quality of the data and the unique information the instrument provides.

The grantee is matching the award from non-Federal sources.

George Castro	TPE 8751835
Society for Advancement of Chicanos and Native Americans in Science	FY87 $5,000
Bethesda, MD	Other NEC

"1987 High School Science Teaching Workshop and SACNAS Conference"

The goal of the project is to help teachers with the planning of programs designed to increase the participation of Chicanos and Native Americans in the sciences. The workshop and conference will consist of science symposia on timely scientific themes, workshops on the improvement of science teaching, and interactions among SACNAS scientists, teachers and students.

COLLEGE SCIENCE INSTRUMENTATION

Gerald D. Robinson	USE 8851942
Towson State University	FY88 $23,091
Towson, MD	Biology

"Biological Equipment for Teaching Instrumental Methods to Undergraduates"

The Department of Biological Sciences is improving its curriculum by introducing an interdisciplinary team-taught course, Instrumental Methods for Biologists. This course corrects a perceived deficiency in the undergraduate training of biologists with regard to the theory and application of sophisticated instrumentation.

Through the combined use of its existing facilities and the additional equipment acquired through this project (and with valued assistance from the Department of Chemistry), the Biology faculty is bringing to its majors fresh insights into the principles of electronics, modern data management, analytical techniques, and physiological monitoring methods. While the new course, "Instrumental Methods for Biologists", is targeted for second- or third-year Biology majors, Chemistry and Physics majors also are invited to enroll in it.

Inclusion of this course in the Biology curriculum provides students with a foundation in the analytical and evaluative techniques that are focal to their fields of inquiry, thus accelerating their transition into competent professionals. This course is facilitating the development of enthusiastic, instrumentation-literate scientists at this university. The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

Linda Sweeting	8711086
Towson State University	FY87 $5,500
Towson, MD	Ethics

"Ethics and the Future of Chemistry: A Symposium"

This grant provides partial support for a symposium on Ethics and the Future of Chemistry, to be held in conjunction with the joint meeting of the American Chemical Society and the Chemical Institute of Canada in Toronto in June 1988. The symposium is composed of two half-day sessions. The first, "Chemical Ethics and Public Perception: Do Chemists' Transgressions Warrant Serious Concern?" will examine the extent of cheating or error in chemistry and public responses to the dangers it perceives. The second half-day, "Ethics and Chemical Education: Preparing Students to Resolve Ethical Dilemmas," will discuss implicit and explicit approaches to teaching of values and ethics to chemistry students. Speakers will be chemists, philosophers and journalists. The sessions will devote time to discussion of case studies and ethical dilemmas by the speakers and the audience. NSF funds will support travel, publicity and taping expenses for the symposium.

Broader coverage, through Chemical and Engineering News, science journals and newsletters, and other reports and publications, is also planned.

COLLEGE SCIENCE INSTRUMENTATION

Joseph J. Topping
Towson State University
Towson, MD

USE 8852251
FY88 $22,500
Chemistry

"Improvement of the Undergraduate Analytical Chemistry Curriculum through the Introduction of Atomic Absorption/Flame Emission Spectrophotometry"

The undergraduate Analytical Chemistry curriculum is being enhanced by incorporating state-of-the-art atomic absorption/flame emission instrumentation into the laboratory courses at the lower level for both majors (Quantitative Analysis) and non-majors (Introduction to Analytical Chemistry). At the same time, this project is facilitating instruction of majors in the upper division courses in instrumental methods and undergraduate research. The spectrophotometer affords a number of capabilities not previously available to students in these courses, for example, flameless atomization, background correction, data storage, editing and reporting, and software control. This is providing a wide variety of student experiences, from fundamental to complex to emphasize both function and application.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Maria Freire
Robert P. Burchard
Jordan Warnick
University of Maryland Baltimore County
Catonsville, MD

TPE 8751798
FY88 $381,372
HS Science

"Science Teacher Enhancement Program"

This is a five-year project in which thirty secondary science teachers from Howard County, Baltimore County, and Baltimore City will participate in a research program at two campuses of the University of Maryland, UMAB and UMBC. The summer components will consist of a seven-week, full-time research practicum in the biological/biomedical sciences and a seven-session research colloquium. The colloquium has three distinct foci: principles of research methodology, recent advances in specific research areas, and translation of research methodology into the classroom. Classroom applications will be the foci of monthly colloquia during the school year. Scientists from the University of Maryland will act as mentors for the research and science educators from each LEA will direct the pedagogical aspects of the program.

Six teachers will be phased in each year of the project with each teacher participating for three years. School districts are cost- sharing a good portion of the total cost to insure that this strategy for teaching science and the introduction of research methodology into the classroom is implemented. The project will lead to an increased understanding of content and appreciation of biological knowledge, preparation for curriculum redesign and improvement, establishment of a cadre of "master teachers" with research experience, and increased interactions among participating teachers and faculty of the University of Maryland.

APPLICATIONS OF ADVANCED TECHNOLOGY

James T. Fey
University of Maryland
College Park, MD

MDR 8751500
FY87 $170,006
FY88 $211,151
FY89 $167,383
Mathematics

"Computer-Intensive Curricula in Secondary School Algebra"

Algebra is the core of secondary school mathematics. It provides concepts, language, and reasoning methods that are essential tools for problem solving in science, technology, and every branch of mathematics. Computer graphic, numerical, and symbolic manipulation tools that are now widely available offer powerful new approaches to algebraic problem solving and to learning algebraic concepts, principles, and skills. Thus computing offers promise of an impressive advance in the scope and effectiveness of secondary school algebra.

This joint University of Maryland and Pennsylvania State University project will complete development, field testing, and evaluation of prototype instructional materials for an elementary algebra strand in secondary school mathematics that reflects appropriate integration of computer tools for problem solving, teaching, and learning. The primary responsibility for curriculum development will rest with the University of Maryland and the teacher preparation and evaluation of the field tests will be done by Pennsylvania State University.

The final products will include model student text materials and computer software guidelines for teacher preparation, analyses of student learning, and guidelines for evaluation of achievement in the coming computer-intensive environments for school algebra.

TEACHER PREPARATION PROGRAM

Anna O. Graeber
Martin L. Johnson
University of Maryland
College Park, MD

TPE 8751456
FY87 $493,117
Mathematics

"Methods and Materials for Preservice Teacher Education in Diagnostic and Prescriptive Teaching of Secondary Mathematics"

This 3-year teacher preparation project will develop and evaluate methods and materials for preparing secondary school mathematics teachers to apply research-based diagnostic and prescriptive teaching strategies. The materials to be developed will provide preservice participants with information to assess student misconceptions and to interpret student performance errors in order to plan and conduct instruction aimed at correcting student difficulties.

Faculty in mathematics and mathematics education from seven teacher preparation colleges will collaborate on the conceptualization, writing, testing, and refining of materials. At the University of Maryland a new course to be required of preservice secondary mathematics teachers will be developed in which the materials will be featured and evaluated.

TEACHER ENHANCEMENT PROGRAM

John W. Layman
Joseph S. Krajcik
University of Maryland
College Park, MD

TPE 8751744
FY88 $326,629
Mid Sch Science

"University of Maryland Middle School Probeware Project"

The University of Maryland Probeware Project is a three-year implementation program which will introduce 74 well-prepared middle school physical science teachers to the use of interfacing boxes and software needed to use the microcomputer as a laboratory tool.In addition, the project will monitor middle school student development of science concepts, graphing skills, and science processing skills. This is a cooperative venture of the University of Maryland Science Teaching Center and schools in local school districts. Middle school physical science teachers will learn to use probeware during introductory and advanced summer workshops.

TEACHER ENHANCEMENT PROGRAM

Paul H. Mazzocchi
University of Maryland
College Park, MD

TPE 8751285
FY85 $66,777
FY86 $86,781
FY87 $98,215
Chemistry

"Honors Research and Leadership Experience for Chemistry Teachers"

This project will provide a research/enrichment/leadership experience for 18 chemistry teachers in the Maryland-Northern Virginia-Washington, D.C. area by recognizing their proven excellence and further strengthening their teaching competencies. This will be accomplished by providing research experience for three summers and advanced course work designed to update and enhance their knowledge of chemistry and prepare them to assist other less experienced teachers. The Department Chairman and Senior Researchers in the Department of Chemistry at the University of Maryland are committed to provide the research experience as a professional responsibility to classroom teachers. Science supervisors in the area as well as Science Teaching Center personnel have offered their support and will participate as advisors so that the experience gained by the teachers can be fully utilized in the school systems. Among the anticipated results will be: 1) a leadership corps of chemistry teachers knowledgeable about research and more confident in their knowledge of chemistry; 2) the establishment of good professional relationships among area teachers and university researchers; 3) the initiation of some research collaboration that can be continued either in the university or in the school environment in conjunction with the university; and most importantly, 4) the improvement of the chemical education offered in area secondary schools.

TEACHER ENHANCEMENT PROGRAM

Paul H. Mazzocchi
University of Maryland
College Park, MD

TPE 8850383
FY88 $117,435
Chemistry

"Honors Research and Leadership Experience for Chemistry Teachers"

This proposal is a renewal of a previously funded three-year project in which groups of six high school chemistry teachers attended eight-week sessions at the University of Maryland. Each group returns for two additional, sequential eight-week summer sessions. Teachers join research groups and become active participants in state-of-the-art research projects in functioning laboratories where they learn new techniques and background material while being introduced to the basic research experience. Teachers learn how chemical knowledge is discovered in a low-pressure environment.

In addition to the research experience, teachers are exposed to advanced coursework and seminars on Current topics in chemistry including teaching methods. Participants are required to write a report and present a seminar on their research in the final week of the program.

This program enables 18 teachers to complete their three-year cycle of research. The University of Maryland is contributing the salaries of the PI, the research mentors and those parts of the teacher stipends which could not be subsidized by their school districts. This cost share is 59% of the NSF funding request.

COLLEGE SCIENCE INSTRUMENTATION

Emin Yilmaz	
University of Maryland Eastern Shore	USE 8750325
Princess Anne, MD	FY87 $16,425
	Materials Eng

"Upgrading of an Undergraduate Materials Testing Laboratory"

The objective of this project is to improve the materials testing laboratory for the Engineering Technology and Construction Management and Technology programs at a primarily minority institution. A new strength of materials course will be developed to support the general engineering program. An IBM PC/XT will be interfaced to a tensile tester to provide experience in automated data acquisition. In addition, an impact tester, polariscope, polisher/grinders, and a materials microscope will be obtained.

COLLEGE SCIENCE INSTRUMENTATION

Juan Lin	
Washington College	USE 8750025
Chestertown, MD	FY87 $6,767
	Physics

"Microcomputer and Data Acquisition System for Undergraduate Physics Projects"

The Physics Department at Washington College will buy a Macintosh, an accelerator board, and a system for data collection in order to do simulations, numerical computation, and data collection and analysis. Students will do projects in the following areas: i) nonlinear dynamics; ii) biological physics; iii) astronomy and astrophysics; and iv) analog-digital interfacing. A dedicated computer system will offer students the possibility to expand their formal work to projects that bring the excitement of current research in physics.

COLLEGE SCIENCE INSTRUMENTATION

James R. Locker	USE 8750059
Washington College	FY87 $5,235
Chestertown, MD	Chemistry

"A Polarographic Analyzer System for Undergraduate Laboratories and Student Research"

A Polarographic analyzer system is being used by the Chemistry Department at Washington College to provide students with extensive "hands on" experience using modern voltammetric methods in analytical chemistry courses. This instrumentation is also being used in student research projects, one of which is concerned with the effects on marine species of increased zinc and aluminum concentrations in the Chesapeake Bay. A forensic chemistry course offered each spring to advanced high school students also utilizes polarographic methods.

YOUNG SCHOLARS

Rosette M. Roat	RCD 8850131
Washington College	FY89 $17,118
Chestertown, MD	FY89 $17,118
	Chemistry

"The Forensic Science Project: It's Analytical My Dear Watson!"

"It's Analytical My Dear Watson!" promises fifteen junior- and senior-high school students an intense multi-disciplinary experience in forensic chemistry, scientific ethics, psychology, criminalistics, and criminology. The Forensic Science Project meets on the campus of Washington College for a two-week summer residential program.

A staged crime constitutes our opening statement. An expert in eyewitness testimony and the effects of discredited witnesses on jurors leads students through a description of the crime and the difficulties and ethical problems posed by their flawed perception of the event. Lecture sessions provide the theory of "wet" and instrumental analytical methods and pose the chemical and criminal puzzles. Beginning with fingerprinting and blood typing participants work up to the use of research-grade instrumentation. These high-schoolers gather data for the growing Chemical Analytical Network, a computer simulation in Forensic Chemistry at Washington College.

In crime and environmental laboratories students observe potential role models working in exciting and rewarding fields. A representative of the Walters Art Gallery speaks to fakes and forgeries in the art world as demonstrated in a recent exhibit there. The course builds to a trial in which students serve as expert witnesses, attempting to convince the judge and jury of the correctness of their forensically gathered evidence.

STUDIES AND ANALYSES

Kenneth Burgdorf
Westat Inc
Rockville, MD

OSPA 8751388
FY87 $249,887
Studies

"NELS:88 Teacher Transcript Study"

This is an unsolicited proposal from Westat, Inc., submitted to the Studies and Analyses Program. It involves a special "Transcript Study" from a teachers questionnaire as part of a large national longitudinal survey called the National Education Longitudinal Survey of 1988 (NELS:88). NELS:88 is supported by the U.S. Department of Education and, as part of it, NSF is supporting a math and science teachers questionnaire under a separate interagency transfer of funds.

The NELS:88 teacher Transcript Study involves the collection and analysis of college transcripts of a national sample of 4,000 eighth grade science and mathematics teachers. The base year phase of NELS:88 will collect extensive information in 1988 about a sample of 27,000 eighth grade students and their schools, teachers, etc. The students' later educational and career development will be tracked in a series of follow-up studies. The Teacher Transcript Study will collect college transcripts for NELS:88 students' science/math teachers and will merge these data with other teacher, school, and student information from the base year cycle of NELS:88. The resulting data base will be used: (a) to describe the educational backgrounds of the nation's current cadre of eighth grade teachers; (b) to examine relationships between teacher education and teacher job/career characteristics, and (c) to examine relationships between teacher education and student achievement. The proposed project will be conducted in two phases. Phase I will be a design and pretest stage linked to the NELS:88 pretest, during the period March 1987, to September 1987. Phase II, to take place in 1988-89, involves the collection of teacher transcript data for the 4,000 NELS:88 math/science teachers, merging these data with school, teacher, and student data from the NELS:88 base-year survey, and analysis of relationships between transcript-based measures of teacher qualifications and other base-year measures (including student achievement in math and science). In addition to the preparation of one or more analytic reports by the project team, a public use data tape will be made available to other researchers.

PROGRAM ASSESSMENT

Kenneth Burgdorf
Westat, Inc
Rockville, MD

OSPA 8850357
FY88 $421,989
Assessments

"Assessment of the Impact of the College Science Instrumentation Program (CSIP)"

This is a national assessment of the CSIP program. CSIP was initiated to support the need for instrumentation in the instructional laboratories that would allow students an opportunity to explore new principles and discoveries with modern equipment. The assessment will concentrate on two aspects of the program -- the effects of funded projects and the impact on institutions of unfunded projects (particularly where proposals were rated favorably, but not funded due to insufficient NSF resources). The Westat assessment will combine a survey of grant recipient institutions and a series of case studies (funded and unfunded) projects.

PROGRAM ASSESSMENT

Elizabeth Farris
Westat Inc
Rockville, MD

OSPA 8818282
FY85 $450,000
FY86 $ 16,000
FY87 $270,234
FY88 $593,210
FY89 $118,696
Studies

"Higher Education Quick Response Surveys"

As part of a basic contract agreement the Directorate for Science and Engineering Education has requested Westat to perform a survey of science, mathematics, and engineering in two-year colleges.

There are over 1300 two-year and community colleges in the United States. Over 4.5 million full- and part-time students attend these colleges, which serve over 52 percent of all Americans who go to college and 41 percent of all full-time freshmen and sophomores. Community colleges are especially important in serving minorities. In 1985 community colleges enrolled approximately 42 percent of all Black, 54 percent of all Hispanic, and 43 percent of all Asian students in higher education at any level.

The National Science Foundation has been requested by Congress to prepare a report on the status of science, engineering, and technology in two-year and community college. This survey of two-year colleges is intended to provide the basic data for this report.

Funds provided by this survey include $140,000 from the Science and Engineering Education Directorate, NSF, and $97,000 from the Department of Education.

MASSACHUSETTS

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Betty Kantrowitz
Mathematics
Newton South High School
Boston, MA

Joseph W. MacQuade, Jr.
Science
Marblehead High School
Marblehead, MA

1988

Judith A. White
Mathematics
McCarthy Middle School
Chelmsford, MA

George S. Taliadouros
Science
Minuteman Regional Vocational Technical School
Lexington, MA

APPLICATIONS OF ADVANCED TECHNOLOGY

Wallace Feurzeig	MDR 8751519
John Richards	FY87 $530,837
Nancy Roberts	FY88 $532,475
BBN Laboratories Incorporated	FY89 $203,264
Cambridge, MA	Mathematics

"Intelligent Tools for Mathematical Inquiry"

The purpose of the project is to design, implement, evaluate, and disseminate a mathematics curriculum sequence for middle school students expressly designed to introduce them to the notions and arts of mathematical thinking and to develop foundational skills of mathematical inquiry. This will be accomplished partly through a laboratory presentation centered on mathematical design activities that span a rich variety of compelling projects, and partly through the use of intelligent tools designed to support and guide constructive exploration and design tasks. The sequence will comprise modules in the areas of algebra, elementary functional analysis, and mathematical modeling. The mathematical content will be developed to support the needs and goals of the inquiry activities. Three major types of tools will be developed, corresponding to qualitatively different ways of embedding intelligent support for open-ended inquiry activities. This work builds on a pilot project which led to the development of prototypes of these tools and their successful classroom trial in an introductory algebra course. The goal of the present project is to extend and deepen the approach and to establish it as a national model for future mathematical curricula.

APPLICATIONS OF ADVANCED TECHNOLOGIES

Wallace Feurzeig	MDR 8850394
Paul Horwitz	FY88 $799,670
BBN Laboratories Incorporated	FY90 $299,968
Cambridge, MA	Mathematics

"Advanced Mathematics from an Elementary Viewpoint: Chaos, Fractal Geometry, and Nonlinear Systems"

Most naturally occurring processes are inherently nonlinear and can give rise to very complex behaviors. Even very simple mathematical models can exhibit behavior that gives rise to extremely convoluted (and often very beautiful) fractal shapes. The discovery of this fundamentally new area of mathematics has been crucially dependent on computationally intensive graphic methods and has given birth to a radically new paradigm for mathematical research: experimental mathematics. Though this material is at the frontier of current research, it is accessible to high school students, and the graphic images that are generated through its investigation are highly informative and often of uncommon visual richness and beauty. Mathematical materials and associated computer software aimed at motivating and empowering high school students of average mathematical ability to perform experimental mathematical investigations will be designed, developed, and evaluated. The mathematical content will comprise fractals, nonlinear dynamics, and mathematical chaos. Fundamental mathematical concepts will be applied to a wide variety of physical, biological and social processes (e.g. population growth, problems in epidemiology, and the economics of the arms race). The deep connection between geometry and nonlinear dynamics will be made explicit by developing computer-based tools that will enable students to generate fractal maps and pictures of compelling complexity and beauty. Finally, through their work in experimental mathematics, students will acquire a deeper understanding of mathematical and scientific thinking.

APPLICATIONS OF ADVANCED TECHNOLOGIES

Ann Rubin	MDR 8751893
Bertram C. Bruce	FY88 $491,575
BBN Laboratories Incorporated	FY89 $530,545
Cambridge, MA	FY90 $133,180
	Mathematics

"ELASTIC: An Environment for Learning Abstract Statistical Thinking"

Recent technological advances and a growing awareness of the importance of teaching statistical reasoning provide us an opportunity to simultaneously advance the state of educational technology and the high school mathematics curriculum. The project director's past two years of research on the role of technology in the teaching of statistical reasoning have led her to focus on methods for making inherently abstract statistical concepts more concrete and therefore more accessible and comprehensible. To implement and test these ideas, a system called ELASTIC (An Environment for Learning Abstract Statistical Thinking) will be developed. The system's pedagogical power will derive from new techniques for visualizing and manipulating abstract statistical entities. Students will be able to interact with concrete representations of statistical objects such as distributions, and statistical processes such as sampling. They will perform experiments in video-and computer-based statistical microworlds. Their analysis process will be guided by a planning environment that will include concrete representations of statistical plans. The system will be tested in the context of a semester-long high school course on Reasoning Under Uncertainty. In parallel, the system will also be used in more controlled settings as a tool for understanding the misconceptions students retain about statistical thinking.

TEACHER ENHANCEMENT PROGRAM

Ann Grady	TPE 8751697
Marilyn Gardner	FY88 $189,446
Nicholas Rubino	FY89 $170,287
Boston Public Schools	FY90 $185,765
Boston, MA	Mathematics

"Elementary Math and Technology (EMAT)"

A collaborative effort on the part of the Boston Public Schools and Boston University, this 39-month project will enable elementary school teachers throughout the school system to integrate computer-based materials into the teaching of mathematics. Several innovative curriculum projects that develop problem solving skills will be reviewed in order to define their place in the elementary mathematics curriculum. Through instruction in mathematics content and interaction with mentor teachers, a total of seventy-five well-prepared K-5 teachers will be readied to use these materials, and to provide inservice instruction to their colleagues. Participants will include bilingual teachers, special education teachers, and teachers of gifted and talented students. The evaluation will assess the project's effect on teaching strategies and on student learning, and dissemination activities will include the production of a videotape.

The Boston Public Schools is contributing an amount equal to 58% of the NSF award.

TEACHER PREPARATION PROGRAM

Gerald L. Abegg	TPE 8652069
Patricia L. Samuel	FY87 $275,795
Boston University	FY88 $509,702
Boston, MA	FY90 $226,054
	MidSch Science

"Boston University Middle School Science Teacher Project"

The project will develop a two-year program for college students who have completed either the sophomore or junior year with a concentration in science. An initial summer is designed to provide an introduction to the foundations of education and schooling and will be followed by a 6-7 week assignment in a camp or other non-school setting for adolescents. A capstone two-semester integrated science course will be developed for the first year which includes concepts in astronomy, biology, chemistry, geology, and physics. The program will include a pro-seminar providing a format for the study of middle school methodology, instructional materials, and curriculum. It will also include field placement. Two special science materials courses, a computer/technology course and continuous professional studies with field components, complete the program. Students will be paired with mentor teachers for the entire final year.

The project is co-directed by a science educator and a research scientist. It is supported by a staff of middle school teachers on leave, faculty from the University's science departments, and a distinguished panel of advisors and consultants.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Robert L. Devaney	MDR 8652157
Boston University	FY87 $140,031
Boston, MA	Mathematics

"Complex Dynamics and Computer Experimentation"

The availability of the computer as a tool for research has enabled mathematicians to make great progress in understanding chaotic behavior in nature. The resulting body of knowledge is fascinating not only because it models physical phenomena but also because it leads to colorful, visually appealing, geometric forms. Moreover, the knowledge of mathematics required to explore these ideas is minimal. Anyone with an understanding of elementary algebra and access to a modest microcomputer can create computer images of chaotic sets and can study their structure.

This project will create a textbook that will make these ideas and activities available for secondary school students. The book will introduce students to the ideas of complex dynamics, fractals, and chaos. It will include simple computer programs that will enable students to generate their own fractal images. Several very high resolution computer generated images will be featured in the book, many in color. Each chapter will contain a series of projects or exercises designed to involve students in the exploration of the relevant mathematics.

The book will be field tested at sites in Massachusetts, Virginia, and Minnesota. It will be published by a commercial publisher.

COURSE AND CURRICULUM

Robert L. Devaney	USE 8813865
Boston University	FY88 $40,306
Boston, MA	Mathematics

"Dynamic Calculus"

An expert fluid dynamicist at Boston University will develop instructional modules, which incorporate ideas from modern dynamical systems theory into the standard Introductory Calculus course. The purpose of this project is to augment the calculus with topics of current research interest.

Materials can be introduced early in a calculus sequence so that students receive early exposure to topics of contemporary research interest in mathematics, computer experimentation in mathematics, and exciting mathematical visual images.

During this one year planning grant several modules which show how certain topics in dynamics may be integrated into calculus, and the role of 'dynamical calculus' in science will be developed.

Over one third of the project's cost will be provided by Boston University.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

TEACHER ENHANCEMENT PROGRAM

Elizabeth A. Godrick	TPE 8751530
Gerald L. Abegg	FY88 $549,000
Albert G. Medvitz	Elem Science
Ruth S. Shane	
Boston University	
Boston, MA	

"The Elementary Teacher as Science Instructor"

The Elementary School Teacher as a Science Instructor will improve the confidence to teach science process and inquiry of 25 pairs of elementary Master Teachers from 25 urban elementary schools in a 28- month program. Two three-week summer sequences of workshops will include the study of astronomy and physics, biology and geology. During the workshops teachers will develop a science leadership plan to incorporate their learning into the classroom and, with the aid of their principals, develop the mechanisms by which they will assume the role of science resource teacher in their schools. During the academic year the teachers will be supported in implementing their plans by release from teaching for two days each month and by interacting with the PI and other staff from Boston University on Saturday mornings, classroom visits, and a hotline.

YOUNG SCHOLARS

George O. Zimmerman	RCD 8850158
Boston University	FY88 $80,037
Boston, MA	HS Science

"Research Internship Program in Science, Mathematics and Engineering"

Twenty-five sophomore and junior high school students participate for six weeks during the summer in research at laboratories affiliated with Boston University. The coordinating staff of Program Directors and Resident Assistants live in the dormitories with the participants. The objective of this Research Internship Program (RIP) is to sensitize students to scientific careers through involvement in research, exposure to questions at the frontiers of knowledge, and exposure to the methods and ideas used to answer them. Each student is paired with a Preceptor, a person actively engaged in research, and works with him or her on on-going research problems. A series of weekly seminars provides a more global view of research in science. These sessions provide coherence to the program and give the students an opportunity to learn from each other as well as from the research community at the university.

INFORMAL SCIENCE EDUCATION

Kenneth S. Brecher	MDR 8318289
Childrens Museum Boston	FY84 $366,406
Boston, MA	FY87 $ 36,640
	Museums

"Interactive Exhibits on Ancient Technology and Modern Technology"

This project will contribute to the science awareness of young children, their parents and their teachers, through a series of six hands-on exhibits that will compare ancient and modern technologies. Each exhibit will be packaged in small modular units, be participatory in nature and designed to elicit exploration as well as insight.

The exhibits will use models, materials and take-home curriculum sheets and materials for use in classrooms, homes, camps and other museums.

The exhibits will be circulated through an itinerary of cooperating museums and will reach an estimated one million persons each year. The Boston Children's Museum has pioneered in the techniques of discovery learning and informal education. Experience indicates that visitors will spend a substantial amount of time in the exhibits and will have a lasting impact from the experience. Each exhibit will include materials related to the history of technology in the particular topic area, activities for visitors and classes, and advice and materials for teachers to use in follow-up classes.

Cooperating museums will have a choice of using the exhibit on either a temporary or permanent basis--by replicating key features and integrating them with other exhibits that are already in place. The project will prepare two initial copies of each exhibit for travelling purposes, and offer to provide blueprints or to manufacture additional copies for museums that prefer a permanent exhibit.

In addition to its cost-effective approach to early learning about science and technology, this project represents an important contribution to cooperative education activities by science museums.

Smaller museums and science centers that lack the experience and skills of the Boston Children's Museum are eager to augment their programs for school and family audiences through this mechanism. Most such museums are almost entirely funded and maintained through local contributions and volunteer activities, so this project will also provide an important encouragement.

COLLEGE SCIENCE INSTRUMENTATION

John F. Axelson	USE 8750546
College of the Holy Cross	FY87 $26,270
Worcester, MA	Psychology

"Modernization of Psychology Natural Science Courses"

This project will provide contemporary research equipment to enable the psychology department at Holy Cross College to upgrade its natural science education. The Psychology Department has, in its short history, made significant progress in establishing a strong research component to its curriculum. However, its equipment has become antiquated and several courses and laboratories lack adequate scientific and computing equipment necessary to provide modern training. The department is currently revising its curriculum to require students to take a minimum number of electives falling within the natural science category of Psychology. This grant will provide up-to-date equipment for specific areas of instruction within this category: physiological, sensation and perception, and cognition and memory. Students will have the opportunity to work with modern equipment and program computers to design experiments, collect, and analyze data.

COLLEGE SCIENCE INSTRUMENTATION

Ronald M. Jarret	USE 8852774
College of the Holy Cross	FY88 $100,000
Worcester, MA	Chemistry

"Improvement of the Chemistry Curriculum Through Fourier Transform - Nuclear Magnetic Resonance Spectroscopy"

Fourier Transform Nuclear Magnetic Resonance (NMR) spectroscopy is being incorporated into the Chemistry program. Acquisition of the instrument is modernizing the way NMR is taught in the laboratories associated with Physical, Organic, and Analytical Chemistry as well as the course for nonscience majors. In addition, the Instrumental Chemistry and Spectroscopy lecture courses and the student research program are being impacted. The acquisition is consistent with the department's effort to provide state-of-the-art instrumentation for both the year long and summer student research program. On average since 1980, thirty-six Chemistry majors (35% women) graduate yearly from the program with 20% going on to graduate school. Since almost all of the undergraduates enroll in research courses and are utilizing the instrument, it is having a positive impact on the continued competence of the Chemistry majors.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Banadakoppa T. Lingappa	USE 8750960
College of the Holy Cross	FY87 $21,064
Worcester, MA	Biology

"Equipment to Support Interdisciplinary Research in Anaerobic Bioconversion for Undergraduates"

This biology-based interdisciplinary project offers an opportunity each year to nearly 40 undergraduates, drawn from diverse subdisciplines of science and humanities, to engage in research in anaerobic bioconversion. This research is of value in educating the liberal arts students, many of whom will become decision makers at various levels in the private and public sectors, to a number of societal problems connected with the disposal of solid wastes. Through field research and laboratory experience, students investigate the physical and chemical composition of biomass (local municipal solid waste, agricultural and animal wastes) and the biological and physical parameters of the anaerobic process that converts the waste biomass into useful chemicals and fuel. Using modern laboratory equipment, science and nonscience students cooperate in generating data on anaerobic digestion.

The grant is providing a gas chromatograph, fermentors, photo-micrographic equipment, and a system for computerized data collection and analysis. With these tools the students are studying such topics as the microbial colonization of the biomass surface, the amount and composition of gases/chemicals produced, reduction of total/volatile solids, and resource economics. This interdisciplinary approach to learning sensitizes science majors to societal concerns, as well as influencing non-scientists to develop a regard for science and an appreciation of its potential for helping solve many of the problems faced by the citizens of a modern technological society.

COLLEGE SCIENCE INSTRUMENTATION

George A. Vidulich	USE 8750477
College of the Holy Cross	FY87 $50,000
Worcester, MA	Chemistry

"Improvement in Advanced Laboratory Using an Instrumental Laboratory Timesharing Concept"

Teaching undergraduates to use modern chemical instrumentation has become increasingly difficult due to the sophistication and complexity of both the instruments and the theory upon which they are based. This situation has aggravated the problem of scheduling experiments at the most opportune time. A unique plan to overcome these difficulties is being implemented by the Chemistry Department of the College of the Holy Cross by merging the Physical Chemistry and Instrumental Analysis Laboratories into a coherent three-semester advanced laboratory program. An orderly progression from basic instrumental laboratory techniques in the first semester to challenging and advanced topics in the third semester is being followed. During the first semester a unique timesharing approach, utilizing the rapid data acquisition capabilities of a an ultraviolet-visible (UV-VIS) rapid scan spectrophotometer and a Fourier Transform Infrared (FTIR) spectrophotometer, makes it possible for all students to concurrently carry out a series of introductory experiments in spectroscopy. During the same semester they will be introduced to the use of the computer as a data station. The culmination of the students' laboratory experience occurs in the third semester where they devote attention to projects centered around some of the challenging and advanced techniques essential to carrying out modern chemical research, including the use of lasers in chemistry, techniques for studying very fast reactions, and microcomputers.

FACULTY ENHANCEMENT PROGRAM

Margaret B. Cozzens	USE 8854210
Consortium For Mathematics and Its Applications, Inc	FY88 $141,387
Arlington, MA	Mathematics

"Undergraduate Faculty Advancement in Mathematics"

Two two-week summer workshops will be held to acquaint undergraduate professors with new curricular ideas in the areas of discrete mathematics, geometry, and their applications. Leaders in each field, both academics and practitioners, will interact with fifty participants from all parts of the Nation to enable them to understand new developments in these mathematical fields and to prepare applications-based materials suitable for use in their classrooms. Areas to be discussed are problem-solving strategies using combinatorics and graph theory, applications of graph theory to social sciences, graphical algorithms in discrete math. In geometry, emphasis will center on tilings, combinatorial geometry, and studies in computational geometry.

A formal follow-up session will be held at the national Joint AMS/MAA meeting in January of 1989, where participants will discuss the impact of the training on their campuses. This meeting will be preceded by two teleconferences, during which the participants and the experts can continue their dialogue and refine the curricula materials developed at the conference.

In addition to the NSF funds, participants' institutions will contribute about 20% in travel costs to the operation of the project.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Solomon Garfunkel	MDR 8318104
Consortium For Mathematics and its Applications	FY84 $673,100
Lexington, MA	FY86 $378,873
	FY87 $357,717
	FY88 $228,780
	Mathematics

"High School Mathematics and Its Applications Project"

This project will develop instructional materials, and materials for the pre- and in-service training of secondary school teachers, that demonstrate the teaching of school mathematics through its contemporary applications. The development and field test process will involve secondary school teachers, administrators, mathematics researchers, and educators, providing a professional environment in which classroom teachers actively participate in the mathematics education community. Materials will include printed modules, enrichment pamphlets, microcomputer software, and video programs designed for teacher and student use. The work will build on existing networks of researchers and educators at both the college and secondary school level to ensure a dynamic process of development and testing that will continue after the completion of the project.

TEACHER PREPARATION PROGRAM

Myles Gordon TPE 8850903
Education Development Center FY88 $27,575
Newton, MA Networks

"Teacher Networks Group Seminars and Workshops"

This proposal requests a portion of the costs for a series of seminars and workshops that will bring together funders and operators of teacher networks, policy makers from state and local levels, leaders of significant educational reform projects, academics and researchers, and representatives of major professional educational organizations and associations. These planning conferences will be devoted to issues of policy and technical issues of the funder-project relationship. The policy seminars will include issues of "school restructuring", the teaching profession, and future funding areas. The technical issues seminars will include the delivery of technical assistance to funded programs, assessment issues across projects, and ideas for sustaining teacher networks.

The NSF portion of the entire effort will be less than one fourth of the actual costs and will be approximately equal to the Carnegie Foundation and the Ford Foundation shares.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Glenn Kleiman MDR 8651637
Education Development Center FY86 $697,960
Center for Learning Technology FY88 $426,405
Newton, MA FY89 $261,494
Mathematics

"Reckoning with Mathematics: Tools and Challenges for the Information Age"

Recent research on mathematics education and the psychology of learning indicates that mathematics instruction should recognize and support the role that students play in constructing their own understanding of mathematics. This requires a curriculum that enables students to experience mathematics as serving useful and interesting purposes, that treats problem solving as the central mathematics activity, and that builds mathematical concepts on concrete experiences.

This project will lay a foundation for a new elementary mathematics curriculum that responds to these needs. It will outline learning goals for a K-6 mathematics curriculum that will enable students to master the mathematical tools and procedures essential for literacy in an information age, define a complete scope and sequence, develop prototype curriculum modules, and produce supporting materials for teacher training and student assessment. The materials will emphasize problem solving and applications of mathematics, incorporate the best traditional materials, and fully integrate the calculator and computer, as tools, into the curriculum.

RESEARCH IN TEACHING AND LEARNING

Daniel H. Watt MDR 8651600
Molly Watt FY87 $147,275
Education Development Center FY88 $ 14,729
Newton, MA Mathematics

"Exploratory Research on Critical Aspects of LOGO Learning: A Collaborative Project with Teachers as Observers"

This project will conduct a 15-month exploratory research effort to examine the feasibility of working with experienced LOGO teachers as collaborative researchers in their own classrooms, to define critical aspects of LOGO learning, and to develop a methodology for assessing and enhancing critical aspects of LOGO learning in elementary classrooms, grades 4-6.

The Principal Investigators plan to accomplish the following specific tasks:

1. To develop a well-defined set of approximately ten critical aspects of LOGO learning, articulated in developmental sequences informed by observations in elementary classrooms, grades 4-6.

2. To develop a draft set of observation, data collection, and enhancement techniques, suitable for use by classroom teachers, with respect to these critical aspects of LOGO learning.

3. To develop and document a methodology of teacher/research seminars designed to enable practicing teachers to observe, enhance, and report on critical aspects of LOGO learning in their own classrooms.

4. To conduct a preliminary study of the professional development of participating teachers as the basis for a testable plan for teacher enhancement, using the research seminar methodology developed by this project.

5. To develop a plan for the next phase of development of a guidebook for teachers on observing, assessing, and enhancing critical aspects of LOGO learning in their classrooms, and for the development of any other educational materials needed to use this approach with less experienced LOGO teachers.

6. To develop a plan for further research based on these methods, in the areas of teacher development and student mathematical learning.

The potential of LOGO as a tool for teaching and learning mathematical (numerical and geometrical) problem solving is vast but unrealized in elementary school classrooms.

The FY88 supplemental award will provide support for additional dissemination of the results of research on critical aspects of LOGO learning by students and teachers at the intermediate grade levels.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Karen Worth MDR 8652126
Nancy Ames FY87 $1,081,530
Education Development Center FY89 $ 573,000
Newton, MA FY90 $ 433,000
Elem Science

"Improving Urban Elementary Science:
A Collaborative Approach"

This project will undertake the design of a program to improve students' abilities to think critically, use language, and solve problems using the natural world as an experimental base. Since urban systems face extremely complex problems, the science program is specifically aimed at these systems. Cleveland and San Francisco will collaborate fully in the development effort. Los Angeles, Pittsburgh, Philadelphia, and Boston will provide input and feedback, to insure that the program meets the needs of a number of urban systems operating under a variety of state and local mandates.

The project will involve teacher development teams in the design of 24-36 activity-based modules for grades K-6. In choosing the natural phenomena to be explored, the project will try to balance life, physical, and earth sciences, tying the experiential base to the urban setting where appropriate. The new modules will be informed by teacher review of existing materials; and will integrate science with the rest of the elementary curriculum, particularly language arts and mathematics.

Boston College Center for the Study of Testing, Evaluation and Educational Policy will serve as the outside evaluator. Delta Education, Inc. will publish the materials as well as assist in the design and dissemination. Delta will invest approximately $2M in the project during the 4-year development stage, and continue to provide marketing assistance and teacher development aid following development.

COURSE AND CURRICULUM

James Callahan USE 8814004
Kenneth R. Hoffman FY88 $141,707
Donal B. O'Shea FY89 $190,845
Lester J. Senechal FY90 $177,738
Norton Starr FY91 $129,392
Five Colleges Inc FY92 $ 74,128
Amherst, MA Mathematics

"Calculus in Context"

Mathematicians from the Five College Consortium of Amherst, Hampshire, Mount Holyoke, Smith Colleges and the University of Massachusetts will restructure the standard three-semester calculus sequence during the next five years.

They will develop a new curriculum in which the four mathematical themes of optimization, estimation and approximation, differential equations, and functions of several variables will be stressed from the beginning. These major mathematical concepts will grow out of exploring significant problems from social, life and physical sciences. Dynamical systems, discrete time models, Fourier series and partial differential equations are some of the concepts which will be explored. The computer will be integrated into the curriculum as a basic conceptual device for structuring the way students think about problems and what it means to solve them.

A national Advisory Board of mathematicians, a scientist, and an engineer will contribute ideas, and give overall guidance in the evaluation. Dissemination will be in the form of team-taught courses, weekend retreats, summer workshops for area faculty and high school teachers and publication of the curriculum. These instructional materials will be used at universities, liberal arts colleges, and high schools.

The Five Colleges is providing significant cost sharing.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

COLLEGE SCIENCE INSTRUMENTATION

Paulette M. Peckol USE 8750160
Five Colleges Inc FY87 $30,115
Amherst, MA Ecology

"A Boat Equipped with Survey, Sampling, and Analysis Equipment for a Five College Undergraduate Marine Sciences Program"

Five Colleges, Inc., a consortium comprised of Amherst, Hampshire, Mount Holyoke, Smith and the University of Massachusetts, will strengthen its interdisciplinary program in Coastal and Marine Sciences. The goal is to enhance the field-research portion of several courses and independent student projects by improving access to marine habitats and by removing the restrictions imposed by the lack of essential, specialized equipment. Specifically, the consortium will purchase a boat which is the laboratory from which students will conduct nearshore and open water experiments. Surveying equipment will permit students to generate accurate, on-site topographic maps of salt marsh and rocky intertidal habitats; coring equipment will enable students to visualize the dynamic processes molding the coastline, recorded in underlying peat and sediment layers. Other equipment, including trawls, gill net, plankton nets, field balance, underwater camera, light meter, and oxygen meter, will provide training in contemporary sampling methodology, and enable students to design sophisticated field experiments. Improving the Coastal and Marine Sciences Program, by taking advantage of the new teaching opportunities represented in modern, analytical field equipment, will make the program more effective in preparing students for successful professional study in marine sciences.

FACULTY ENHANCEMENT PROGRAM

James A. Davis	USE 8854204
Harvard University	FY89 $85,851
Cambridge, MA	FY89 $91,450
	FY90 $97,269
	Sociology

"An Undergraduate Faculty Program in the Social Sciences to Enhance Quantitative Instruction on American Society"

This project will make available recent developments in quantitative research on American society to undergraduate teachers. These developments are based in the creation of large data sets on American society, in the application of powerful statistical techniques to contingency table analysis, and in programming these techniques for micro-computers. In addition, instructional materials have been developed in the last few years which facilitate the undergraduate teachers' task of conveying this knowledge to undergraduates.

The convergence of these developments will be the focus of an interdisciplinary program for enhancing undergraduate faculty skills. In each of three years, twenty faculty who teach primarily undergraduates in Sociology, Political Science and American History will participate in an intensive, seven-day introductory workshop at Harvard University. The Workshop will be led by James A. Davis, who created the General Society Survey, contributed to the Development of contingency table analysis and development of contingency table analysis and developed the micro-computer programs which make these data and statistical techniques accessible to undergraduates. Participating faculty will cover the major substantive findings from the GSS and the National Election Study (NES), statistical techniques and computer programs which make these findings accessible at the undergraduate level, and also work with student exercises and data sets created by the staff of the workshop; that explore these recent developments on microcomputers.

Following the initial Workshop, faculty participants will prepare their own instructional materials adapting these new developments to their individual teaching situations. Workshop participants will return within a year for a shorter Demonstration Workshop in which they discuss the instructional innovations they have made with other graduates of their workshop and up-date their knowledge about data and appropriate computer programs. Over the three years, it is expected that the Programs will have a significant impact on undergraduate teaching about American Society at the institutions represented.

In addition to the NSF funds, participants' institutions will contribute about 10% in travel costs to the operation of the project.

COURSE AND CURRICULUM

Andrew M. Gleason	USE 8813997
Deborah Hughes-Hallett	FY88 $20,362
Harvard University	Mathematics
Cambridge, MA	

"The Language of Change: A Project to Rejuvenate Calculus Instruction"

In a one year planning grant, a group of mathematicians led by Andrew Gleason of Harvard University and from a broad spectrum of institutions/regions will design calculus syllabi outlines. They will investigate the use of computers/calculators in opening up new topics and new ways of teaching.

They will completely rethink the goals and content of calculus courses; establish closer collaboration with representative of client disciplines; plan the creation of tests; and plan the development of materials to be used in workshops on pedagogy.

The team consists of mathematicians from Harvard University, University of Arizona, Colgate University, Haverford College, University of Southern Mississippi, Stanford University, Suffolk Community College, and Chelmsford High School.

STUDIES AND ANALYSES

Gerald Holton	OSPA 8850686
Harvard University	FY88 $327,648
Cambridge, MA	Studies

"Study of Access of Women Scientists and Engineers to Research Careers"

A larger proportion than ever before of American women (including minority women and disabled women) will have to become available to join the science and engineering (S/E) workforce during the next two decades, if only to help stem the decline in the total S/E workforce now expected on the basis of demographic data. An important transition phase in the careers of future women scientists/engineers is the immediate postdoctoral period, during which a serious differential in participation in S/E occurs. Previous attempts to understand such attrition have been only partly successful. The whole population of women scientists/ engineers, as well as matched samples of men as control, all of whom in the past received Postdoctoral Fellowships from NSF and NRC, will be studied. Quantitative and qualitative data, obtained through standard survey and analysis methods, will be used to provide a fuller description of the existing barriers, and to formulate and test propositions that can help guide policy for their amelioration or removal.

STUDIES AND ANALYSES

Richard J. Murnane
Harvard University
Cambridge, MA

OSPA 8554462
FY86 $249,952
FY87 $ 98,918
Studies

"Analyses of the Factors Influencing How Long Math and Science Teachers Stay in Teaching"

This research will analyze the factors that influence how long math and science teachers stay in teaching. These factors include personal demographic characteristics, subject area specializations, salaries, and school district characteristics. The investigators will use methodologies, known as waiting time models, that have not been used previously in studying teachers' career paths. They will apply these powerful methodologies to three longitudinal data sets, from rich data on individual teachers in Colorado, Michigan, and North Carolina.

The research will emphasize comparisons between math and science teachers and other teachers, between teachers trained to teach particular sciences, between time periods (early 1970's versus early 1980's), and between regions of the country.

The results should be valuable for two reasons. First, they will inform policy discussions about how to increase the attractiveness of the teaching profession to college graduates with math and science training. Second, they should provide information useful in improving the teacher demand and supply models used to predict teacher shortages and surpluses.

PRIVATE SECTOR PARTNERSHIPS

Susan N. Friel
Mildred Feloney
Lesley College
Cambridge, MA

TPE 8851042
FY88 $203,855
Other NEC

"Project SPARK: Private Sector Partnership to Kindle Young Women's Interest and Involvement in Science"

Recognizing the problems of attracting women into science-related careers and the critical nature of the middle school years in career decisions, this project will develop and test several unique strategies for creating and sustaining an interest in science among young women. First, all the science activities will be built from personal interest of female students of the age to counter the often heard complaint by girls that science is boring. Second, the science activities will take place in a variety of settings -- traditional school environments, on weekends, at home, in after-school clubs, and at the Boston Museum of Science -- to demonstrate that science knowledge and activities relate to all aspects of life. Third, the activities will be led by women who are models for the young girls -- women scientists, women relatives, women teachers, and girls from older peer groups -- to counter the male dominant atmosphere of most formal scientific environments. Finally, the whole project will be planned and implemented by a team of people representing school and college faculty, business and industry, and the Museum of Science. The hypothesis that the diversity in the people and programs involved in this project will significantly improve the probability of creating an interest in science in young women will be tested.

Cost sharing by the partners will total 25% of the NSF funding.

NETWORKS PROGRAM

George E. Hein
Lesley College
Cambridge, MA

TPE 8850382
FY88 $47,538
Elem Science

"Elementary Science Assessment Planning Conference"

There is a growing interest in the country for reform in the area of elementary science education. While most science educators recognize the need for hands-on science education, those currently engaged in reform efforts recognize that one of the crucial failings of the previous curriculum work in this area was the inability or unwillingness of developers to devise new forms of student assessment to meet the needs of material-based science programs. This proposal is for an invitational conference to address the need for curriculum-independent tests and assessment tools for classroom teachers to use in conjunction with instruction. New ideas about elementary science assessment can come from other curriculum areas (reading and writing), recently developed indicators of science achievement such as the National Assessment of Educational Progress assessment, new NSF-supported curriculum developments, and research on children's conceptions of science. The conference, based on a series of commissioned papers, will address how these developments can form the basis for new instruments and methods. The result will be a monograph for wide dissemination and suggestions for future developmental work in elementary science assessment.

TEACHER PREPARATION PROGRAM

Linda Schulman TPE 8652049
Lesley College FY86 $198,791
Cambridge, MA FY87 $209,316
FY88 $206,135
FY89 $197,931
FY90 $161,329
Mathematics

"A Model Program for Preparing Pre-Service Middle School Science and Mathematics Teachers"

Lesley College, a women's undergraduate college, is developing a program for preparing preservice middle school science and mathematics teachers. Following the recommendation of the National Middle School Association, the program will provide content concentration in two areas, science and mathematics. The project, now beginning its second year, is designing a sequence of 40 credits in mathematics and science, including nine with an unique interdisciplinary focus. Five science courses, and five professional courses will be developed or modified. The interdisciplinary component elaborates the interrelationships between mathematics, science, society, and the teaching profession. The emphases is to be on methods of inquiry, criteria for truth in different disciplines, and an understanding of the nature and limits of knowledge. The interdisciplinary component will culminate with a student research project in the natural sciences using scientific and behavioral science methods. The 29-hour professional education component will culminate in an all-integrating seminar, which will challenge students to create new visions and alternatives for curriculum development and education. The program is being developed by teams of scientists and educators.

The project incorporates collaborative relations with the public schools and a science laboratory resource center at the college. The project is also developing strategies for recruiting talented women into the middle school teaching profession. Thorough evaluation is an important element in the program.

The project director, a mathematics educator, is assisted by members of Lesley College's science and mathematics departments and by a distinguished advisory committee.

COURSE AND CURRICULUM

Jack L. Kerrebrock USE 8751507
Massachusetts Institute of Technology FY87 $35,000
Cambridge, MA FY88 $94,948
Engineering

"Workshop on Engineering Education"

The Forum on Engineering Education (1987) is being convened by a Consortium of MIT, Stanford and the University of California at Berkeley with the support of NSF, as a first step toward organization of a consortium of research universities and primarily undergraduate institutions to address the crucial problems of engineering education in the U.S. The Forum will proceed from the premise that better collaboration of these types of institutions can help mitigate the problems such as faculty shortages, and technical obsolescence of faculty and practicing engineers, which face engineering education in the U.S. A three day workshop format is planned, with participation by two persons from each of several institutions in addition to those representing the members of the Consortium.

FACULTY ENHANCEMENT

James E. McCune USE 8854183
Harold Y. Wachman FY88 $85,569
Earll M. Murman Aeronautical Eng
Massachusetts Institute of Technology
Cambridge, MA

"A Workshop on Teaching Fluid Mechanics with Workstation Based Software"

A workshop will be held at MIT during the summer of 1988 to introduce faculty from other institutions to the possibilities of enhancing the teaching of undergraduate fluid mechanics with workstation based software. Twenty participants will be introduced to this new media using software developed over the past four years at MIT. The participants will be encouraged to think of new uses and new approaches for the software, asked to develop problem sets, and required to critique the workshop. The activity will expand to a National level a collaboration of teachers which has started at MIT.

In addition to the NSF award, participants' institutions will contribute about 15% in travel funds toward the cost of the project.

APPLICATIONS OF ADVANCED TECHNOLOGY

Seymour A. Papert MDR 8751190
Massachusetts Institute of Technology FY87 $500,000
Cambridge, MA FY88 $500,543
FY89 $505,557
Elem Science

"Constructionism: A New Opportunity for Elementary Science Education"

The word constructionism is a mnemonic for two aspects of the theory of science education underlying this project. From constructivist theories of psychology we take a view of learning as a reconstruction rather than as a transmission of knowledge. Then we extend the idea of manipulative materials to the idea that learning is most effective when part of an activity the learner experiences as constructing a meaningful product.

Specifically a set of new materials will be developed for learning science in elementary schools. The materials use a new cut across science, organizing many traditional concepts under the heading of motion science, information science, and color science.

The materials will be designed to make better use of the level of computer presence that is now becoming common in schools.

The design of the new materials pays special attention to the role of affective, cultural, and gender-related facets of learning science.

The materials will be developed in an inner city public school in Boston and evaluated in a number of test sites at associated schools in several states for dissemination to schools covering the full range of socio-cultural variation in American education.

COURSE AND CURRICULUM

David G. Wilson — USE 8854570
Massachusetts Institute of Technology — FY88 $216,022
Cambridge, MA — Engineering

"Education for Engineering Design"

The object of this project is to provide self-study resources for students who perceive that their preparation for design courses is inadequate in some respects. The same resources can give information in depth to more advanced engineering students. A computer-based system that will allow students to design components, to choose methods of assembly, and to select data is to be developed. Such a system gives information presently not available in any one textbook, and could provide remedial and advanced guidance for freshmen and more advanced students. It is capable of continual updating and enhancement.

This project is co-funded with the NSF Directorate for Engineering.

COLLEGE SCIENCE INSTRUMENTATION

Ronald M. Pike — USE 8851510
Merrimack College — FY88 $23,000
North Andover, MA — Chemistry

"An Integrated Four Year Spectroscopy Program"

Fourier Transform Infrared (FTIR) Spectroscopy is being incorporated into an integrated four-year spectroscopy sequence and into professional education programs. The program is impacting the laboratories in General, Organic, Inorganic, Physical, Analytical and Biochemistry, as well as senior research. The addition of FTIR upgraded the instrumental facilities and is allowing the offering of well-balanced, modern laboratory experience.

Many of the changes were initially implemented using a loaned FTIR instrument, which were made permanent by this project enhancing both the academic and professional programs.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Zvi Szafran — USE 8852203
Merrimack College — FY88 $34,937
North Andover, MA — Chemistry

"Nuclear Magnetic Resonance Instrumentation for Enhanced Undergraduate Instruction"

The level of instruction of undergraduate Chemistry is being improved through the acquisition of a Proton Nuclear Magnetic Resonance Spectrometer. Existing courses being impacted by this proposal include: Organic Chemistry, Inorganic Chemistry, Physical Chemistry, Chemical Instrumentation, General Chemistry, and Senior Research. In addition two courses for professionals, "Chemical Instrumentation" and "Microscale Qualitative Organic Analysis" are being improved. The instrument is making it possible to integrate the laboratory experience with the lecture material in the areas of structure identification, quantitative analysis, kinetics, and industrial chemistry.

The grantee is matching the NSF award from non-Federal funds.

COLLEGE SCIENCE INSTRUMENTATION

Peter J. Gruber — USE 8851401
Mount Holyoke College — FY88 $37,053
South Hadley, MA — Biology

"Equipment to Modernize an Undergraduate Physiology Curriculum"

While students were receiving a modern view of physiology in their classrooms, their physiology laboratory experiences before the advent of this project in many instances were quite inadequate. Many of introductory and intermediate-level laboratories or projects were of a descriptive rather than an analytical nature. Other physiology-related laboratories or projects employed somewhat primitive equipment. A modern study of physiology even at the undergraduate level requires considerably more sophisticated equipment and methodologies than were available.

The objectives of this project are to enhance the quality of the laboratory in several physiology-related courses by moving the laboratory experience from the descriptive to the analytical.

With the new equipment and the new or modified procedures recently introduced, students are able to make accurate collections of complex and meaningful data and to analyze it in the manner of the modern physiologist. Equipment includes a number of different transducers, and two multipurpose minicomputers complete with the hardware and software needed to interface with this equipment in a number of different configurations to study elements of both plant and animal physiology.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Deborah Schifter	TPE 8850490
Mount Holyoke College	FY88 $138,201
South Hadley, MA	FY89 $206,239
	FY90 $100,590
	Mathematics

"Mathematics Leadership Network"

The main goals of the project are to offer a comprehensive mathematics inservice program to 125 teachers in southwestern New England over a period of two years plus follow-up activities. The participants are to learn how to serve as resource teachers in their respective school districts. The program builds on a previously funded project whose primary focus was directed to elementary school teachers. This project expands the previous efforts to offer experiences to elementary and secondary teachers. Also, the model developed in the previous project is to be expanded here, both in subject matter background and in pedagogical considerations, especially with emphasis of the constructivist approaches to mathematics instruction. There are four components to the present project: a two-week summer institute to provide concentrated and intense activities; follow-up during the academic year by project staff to help the participants implement the pedagogical structures; academic courses offered during the school year; and finally, a supervised internship as resource teachers. The project was designed with local support and guidance as an outgrowth of the previously funded project and in response to needs expressed by teachers and administrators who participated in the earlier project. The participants are selected from among those recommended by the school districts that have committed to the project. The cost sharing is $182,101, which is 41% of the funds requested from the National Science Foundation.

TEACHER ENHANCEMENT PROGRAM

Martin A. Simon	TPE 8552391
Mount Holyoke College	FY86 $292,677
South Hadley, MA	FY88 $166,278
	Mathematics

"Educational Leaders in Mathematics Project"

This project will serve 120 exemplary mathematics teachers from the western Massachusetts and Connecticut area. The overall goals of the multi-year project involve the updating and deepening of the participants' mathematical understanding and teaching methodology (with emphasis on problem solving and the constructivist perspective), the networking of the staff and participants through regular school visitations and group workshops, the conduct of frequent in-service sessions by the participants in their school, and investigation of the model's effectiveness.

COLLEGE SCIENCE INSTRUMENTATION

Abha Sur	USE 8750925
Mount Holyoke College	FY87 $21,275
South Hadley, MA	Chemistry

"Instrumentation for the Physical Chemistry Laboratory"

The recent acquisition of a Fourier Transform Infrared Spectrophotometer is enabling the Chemistry Department at Mount Holyoke College to significantly expand the scope and sophistication of the laboratory curriculum in physical chemistry, in a methods of measurement course, in micro-scale organic chemistry and in independent research.

COLLEGE SCIENCE INSTRUMENTATION

Robert J. Weaver	USE 8750848
Harriet Pollarsek	FY87 $36,525
Mount Holyoke College	Mathematics
South Hadley, MA	

"Computer Laboratory for Mathematical Experimentation"

The Mathematics Department at Mount Holyoke College will purchase a micro VAX-II, peripherals, and software in order to establish a mathematics computer laboratory to be used in three ways. First, students in a course, required of majors, called Laboratory in Mathematical Experimentation, will investigate mathematical problems which are best attacked using a computer. Examples of these are topics in chromatic polynomials and unimodality; topics dealing with prime numbers; randomness; chaotic dynamical systems; the Mandelbrot set. This laboratory will force students to come to grips with mathematical ideas through experimentation and conjecture, ensure some proficiency with the computer, and help foster precise thinking and writing. Second, in advanced courses students can build on their experience in the laboratory to use the computer more easily to work on interesting problems. Third, in senior independent work the availability of the computer will increase the number and sophistication of independent projects available to a student, and she will have had considerable experience so that she can start the project at a higher level.

FACULTY ENHANCEMENT

Kenneth L. Williamson
Mount Holyoke College
South Hadley, MA

USE 8854142
FY88 $47,915
Chemistry

"Microscale Organic Experiments: A Summer Institute"

A new approach to teaching undergraduate Organic Chemistry lab is to carry out the experiments on 1/100th to 1/1000th the scale previously used. In this way student exposure to substances which are toxic, flammable, corrosive, carcinogenic, teratogenic, and mutagenic is reduced by a corresponding amount and there are concomitant savings in the disposal of laboratory waste and the purchase of reagents and solvents. Since the apparatus and techniques differ from those used in the past, faculty need some guidance before embarking on this way of teaching the undergraduate organic laboratory. To this end three week-long workshops on teaching microscale organic experiments will be conducted at Mount Holyoke College in June of 1988. Participants will have an opportunity to carry out microscale experiments under the guidance of the project director, the author of a recent laboratory manual in microscale organic chemistry, assisted by undergraduates who have helped develop these experiments.

In addition to NSF funds, participants' institutions will contribute about 40% in travel costs toward the cost of the project.

INFORMAL SCIENCE EDUCATION

Lawrence Bell
Betty Davidson
Charles Howarth
Museum of Science
Boston, MA

MDR 8652311
FY87 $199,528
Museums

"Making Natural History Exhibits Multi-Sensory: Improving Learning for Disabled Visitors"

The Museum of Science in Boston proposes a major modification of its permanent New England Wildlife Zones exhibition hall in order to improve its effectiveness with visitors with impaired sight, hearing, or mobility. They will document and share with other museums the successful methods and techniques used in the exhibition development process in an effort to improve barrier free access in the country's more than 600 science and natural history museums.

The museum has completed a preliminary needs assessment with the assistance of handicapped consultants, developed alternative design solutions to problems of limited accessibility and effectiveness for the hall's existing dioramas, and organized a design team that includes senior museum exhibition and education staff and a handicapped scientist and educator as Co-PI. The Massachusetts College of Art's Adaptive Environments Center will provide assistance in design for the handicapped and evaluation will be under the direction of George Hein, head of Lesley College's Program Evaluation and Research Group.

Following an extensive design and evaluation process, new exhibit units will be constructed as educational adjuncts to the existing hall of dioramas, and the impact of the changes will be assessed, as part of a dissemination plan that will include popular and professional papers and a "how to" work book distributed to science museum exhibit designers with the assistance of the Association of Science Technology Centers and the American Association for the Advancement of Science.

TEACHER ENHANCEMENT PROGRAM

Frank Gardner
Museum of Science
Boston, MA

TPE 8554405
FY86 $332,770
FY88 $150,000
Elem Science

"Collaborative Institute for Improving Science Literacy Among Elementary School Teachers"

Museum Institute for Teaching Science, MITS, is a collaborative project of the Arnold Arboretum, the Boston Children's Museum, the Boston Zoological Society, the Massachusetts Audubon Society, the Museum of Comparative Zoology, the Museum of Science, and the New England Aquarium. During three-week summer institutes 85 elementary teachers are provided with information and skills to improve the science process and content in their classrooms, increase their science literacy and gain a positive attitude about teaching science. A program newsletter "Science is Elementary" is distributed to a broad audience.

INFORMAL SCIENCE EDUCATION

Leslie S. Kaufman	MDR 8650095
Richard Lyons	FY86 $ 61,050
New England Aquarium Corporation	FY87 $212,921
Boston, MA	Museums

"The Thinking Gallery: Development of an Inquiry-Driven Gallery in a Living Museum"

The New England Aquarium will develop an "inquiry-driven" gallery for the study of aquatic sciences in a move to go beyond the "naming" experiences in biology and environmental education.

The project will focus on seven conceptual themes: 1) adaptation and evolution; 2) habitat; 3) life cycles; 4) development and metamorphosis; 5) species interactions; 6) energy flow; and 7) signals and senses. The exhibits will challenge the visitor with questions, puzzles and games. Curriculum materials will be developed for teachers along with a users guide for visitors. Outreach activities are planned, aimed at minority students and visitors. The Aquarium serves approximately 155,000 students and over one million visitors every year.

The redesigned gallery will house eight tanks, ranging from a series of small tanks with accompanying video clips that display seldom seen behaviors such as the "birth" of seahorses, lobster molting, etc. to three 250-gallon tanks that will display ancient fishes and a variety of species showing different kinds of locomotion, color and sound. A 2500-gallon tank housing a school of fish will demonstrate different ways terrestrial and aquatic animals sense their surroundings. A 4000-gallon floor-to-ceiling tank will display a salt marsh on one side and a mangrove forest on the other and a 6000-gallon tank will house large groupers, moray eels and small gobies. The NSF award represents $273,971 out of a project total of $857,986.

INFORMAL SCIENCE EDUCATION

Valerie Crane	MDR 8652163
Research Communications Ltd	FY87 $27,700
Chestnut Hill, MA	Studies

"Evaluation of a TV Science News Service"

Commercial television is a powerful medium that has rarely succeeded in bringing scientific and technological information to its vast viewing public. For approximately eight years Don Herbert and his series "HOW ABOUT..." has brought science news to millions of viewers across the country. This series is carried on over 150 commercial TV stations in 80% of the major markets. The objectives of the program are to further the public's understanding and appreciation of the importance of science, technology and medical research to our way of life. Research Communications Ltd. will conduct a two-tiered study to determine the impact and effectiveness of these news inserts. A telephone survey will be conducted with station managers and news directors to document the decision-making process. The second step involves a series of focus groups with home viewers to determine the effectiveness of the series. Viewers will be asked a series of questions as well as responding to sample news segments.

RESEARCH IN TEACHING AND LEARNING

Valerie Crane	MDR 8851073
Research Communications Ltd	FY88 $184,384
Chestnut Hill, MA	Mathematics

"The Study of Informal Mathematics Learning: A Case Study Using Square One TV"

A goal of this study on informal mathematics learning is to increase understanding of how perceptions of and attitudes toward mathematics can be mediated with television programming -- Square One TV -- designed for this purpose. This study will be conducted to determine characteristics of the learner and informal mathematics learning experiences; examine the viewing experience over a four- to six-week period to understand the context in which informal mathematics learning occurs; determine program characteristics which facilitate positive thinking about mathematics; and reveal affective and cognitive outcomes from viewing including participation in activities while viewing, follow-up activities which result from viewing, and change in perceptions about and attitudes toward mathematics. One-on-one in-home interviews will be conducted on a pre- and post-test basis over a four-to six-week period with 600 child-parent pairs. Children from age 4 to 12 and one of their parents will be interviewed. Intermediary telephone interviews will permit careful tracking of actual viewing time and of what happens during viewing. Three conditions for informal learning will exist between the pre- and post-test. Two hundred child viewers will have no encouragement to view, another 200 will be encouraged to view a designated amount of television in the time slot when Square One TV airs, and a final 200 will be encouraged to view Square One TV on a regular basis. Outcomes of the study will be increased understanding of informal mathematics learning, refinement of a model for informal learning, and directions for research in this area.

TEACHER ENHANCEMENT PROGRAM

Susan E. Humphris
Sea Education Association
Woods Hole, MA

TPE 8652383
FY87 $155,000
Marine Science

"SEA Experience: A Theoretical and Practical Summer Program of Teacher Enhancement in Marine Sciences"

This program offers an intensive five-week summer educational program in Marine Sciences for upper elementary, junior high and high school teachers. The program is designed to provide teachers with a general knowledge of Marine Sciences, ideas for field and lab work that they could implement in their classrooms and, most importantly, a practical experience of working and living at sea that would build confidence in their understanding of the subject.

The shore-based, three-week component will be held in Woods Hole and will consist of an intensive 50-hour course of lectures, labs, workshops, and field trips in Marine Sciences. This course will emphasize the basic concepts in physics, chemistry, geology, and biology that can be conveyed to students through studies of the oceans. It will be directed towards development of curricula to be implemented in the classroom. In addition, two short lecture series -- one entitled "Massachusetts and the Sea" and the other on various topics in Nautical Science -- will be presented in order to enhance the subsequent experience that the teachers will have at sea.

The final two weeks of the course will be spent on board a fully equipped oceanographic research vessel, the R/V Westward, where the practical hands-on experience of carrying out research projects and participating in the operation of one of the few remaining "tall ships" that practice marine research, will build confidence in the scientific knowledge the participants have gained, and will refresh and revitalize their teaching.

COLLEGE SCIENCE INSTRUMENTATION

James U. Piper
Simmons College
Boston, MA

USE 8853324
FY88 $59,049
Chemistry

"Enhancement of the Chemistry Curriculum by Replacement of an Outdated Nuclear Magnetic Resonance Spectrometer with a Fourier Transform Spectrometer"

A Fourier Transform (FT) instrument is providing students access to a central instrument for chemistry analysis and providing hitherto unavailable laboratory experience with topics now covered in the curriculum including the important techniques of Carbon-13 NMR spectroscopy and Fourier Transform methods. The instrument is also supporting a new Biochemistry Program which is being developed. The instrument purchased is flexible enough to be used with the lower division curriculum, but with specifications which permit it to meet the demands of advanced courses in physical, analytical, organic, and biochemistry. The instrument is also being used to support senior research projects.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

N.Sandra Williams
Velda Goldberg
Herbert Pandiscio
Simmons College
Boston, MA

TPE 8751346
FY87 $150,831
FY89 $240,828
Elem Science

"Administrator-Teacher Partnerships in Elementary School Science"

This project is aimed at improving science education at the elementary level by developing partnerships between elementary school administrators and elementary school teachers. To achieve the broad goal of superior science and mathematics achievement, all citizens, not only those of exceptional ability, must be versed in science, technology, and mathematics. This effort must begin at the elementary level with rigorous, hands-on programs. While many projects have contributed to some aspects of the problem by addressing teacher competency, retraining and revitalization, little attention has been given to the role of the building-level administrator.

This project will help principals and teachers define the essential characteristics of an excellent science program, evaluate their own programs and bring about carefully planned change, first within individual schools and then across districts. Two groups of 35 principal/teacher pairs will attend summer workshops at Simmons College. They will construct specific plans for improvement of the science programs in their schools and districts and implement their plans during the academic year following each workshop. Finally, both groups will reconvene to discuss the implementation of their plans, evaluate the overall project, and formulate ways to sustain their partnerships and expand their networks. This project will bring together representatives from various constituencies -- principals, teachers and science specialists from elementary schools, university and industrial scientists, science museum and science resource center personnel -- to work toward excellence in elementary science education.

COLLEGE SCIENCE INSTRUMENTATION

Elizabeth S. Ivey	USE 8750163
Smith College	FY87 $6,397
Northampton, MA	Physics

"Improvement of an Advanced Undergraduate Acoustics Laboratory"

This project will improve an advanced undergraduate teaching and research laboratory in Acoustics at Smith College. The Physics Department will acquire the capability to use holographic interferometry to identify, demonstrate, and analyze the vibrational modes of various objects, starting with musical instruments. For this project Smith will purchase a vibration isolated optical table and base, vibration exciter, accelerometer, digital shutter, variable attenuator/beam splitter, and spatial filter.

The Acoustics course requires a semester-long experimental project from physics majors taking the course, and shorter projects may be elected by non-majors. In addition, the Acoustics laboratory is used by seniors doing Honors and Special Studies projects. Having the capability to use holographic interferometry in the identification of vibrational modes will provide several additional laboratory experiments for the Acoustics course as well as giving majors another technique for use in their experimental projects.

COLLEGE SCIENCE INSTRUMENTATION

Robert N. Leamnson	USE 8851458
Southeastern Massachusetts University	FY88 $20,812
North Dartmouth, MA	Biology

"Equipment for Isolating Plasmid DNA and Cytochrome p450 in Undergraduate Laboratories"

This project introduces into undergraduate physiology, biotechnology and molecular biology laboratories a set of new experiments that involve the isolation of the microsome component of cell lysates and closed-circular, non-chromosomal DNA from bacteria. The new ultracentrifuge procured through this project is used to isolate the microsome fraction from cells of marine animals that have been exposed to xenobiotics (artificially exposed in the laboratory or exposed via polluted waters). Students study the effect of xenobiotics on the quantity and functions of the mixed function oxidase system, a cytochrome p450.

In other experiments, students use ultracentrifugation to isolate and characterize either large endogenous plasmids from Thiobacillus versutus or closed-circular DNA vectors carrying a variety of inserts. (Such isolations normally involve overnight centrifugation in cesium chloride/ethidium bromide, with or without prior high salt/SDS treatment.) An additional longer-term goal is for students in undergraduate research projects to isolate from sucrose gradients E. coli minicells containing the T. versutus plasmid. In all cases the expertise and support materials had been available to do these projects, but a reliable ultracentrifuge was not. The new equipment, therefore, is facilitating useful and important curricular changes.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

RESEARCH IN TEACHING AND LEARNING

Judith E. Sims-Knight	MDR 8410316
James J. Kaput	FY85 $113,791
Southeastern Massachusetts Univ	FY86 $ 55,510
North Dartmouth, MA	FY87 $ 79,628
	Mathematics

"Teaching Students to Use Mathematics: Eliminating Errors in Mapping from Natural Representational Systems to the Abstract Symbol Systems of Mathematics"

The overall goal of this research project is to understand why students have difficulty solving algebraic word problems and to investigate instructional materials that are effective in remedying these difficulties.

In previous research, the principal investigators have: 1) identified several component skills related to performance on a particular subclass of algebraic word problems that require students to translate problem content into algebraic form, and 2) have developed techniques to help students develop these component skills. In the current study, the principal investigators will conduct teaching experiments to explore whether the specific component skills are necessary and sufficient to overcome the problem-solving difficulties.

Three computerized modules for teaching underlying skills will be developed (one in algebraic transformations, a second in nonalgebraic transformations, and a third in algebraic symbolization). Their effectiveness will be tested with high school students of varying mathematical abilities. By analyzing data on individual measures and on the experimental procedure, the investigators will examine how individual differences in mathematical ability and learning experiences interact in their influence on problem solving. The results of these analyses are particularly relevant to the practical issue of how best to provide the experiences necessary for otherwise competent students to develop problem-solving skills essential for succeeding in mathematics courses.

COLLEGE SCIENCE INSTRUMENTATION

Jefferson T. Turner
Robert H. Caverly
Southeastern Massachusettes University
North Dartmouth, MA

USE 8851158
FY88 $66,422
Biology

"Scanning Electron Microscopy for Undergraduate Science and Engineering Education"

Students in Biology, Electrical Engineering and other fields of study learn to use the Scanning Electron Microscope (SEM) for measurements related to their major area of study. A formal course that teaches students the principles of operation and the capabilities of the SEM as well as the procedures for using the instrument is offered on a regular basis. The particular instrument has several features that allow measurements not possible with instruments not possessing these features. After completing the course, the students have access to the SEM for individual project work.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Chang-Ning Wu
Southeastern Massachusetts Univ
North Dartmouth, MA

USE 8750943
FY87 $14,934
Chemistry

"The Use of a Computer-Interfaced Differential Scanning Calorimeter in the Undergraduate Laboratory: A Class-Project Oriented Program"

A computer-interfaced Differential Scanning Calorimeter is being used in the polymer chemistry laboratory course for advanced undergraduates in chemistry and textile chemistry at Southeastern Massachusetts University. A class project orientation is used in which students prepare a series of liquid crystal polymers with different structures. Characterization data is obtained using the calorimeter and students pool their results to reach conclusions on structure/property relationships.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Susan N. Friel
Susan Jo Russell
Technical Education Research Center
Cambridge, MA 02138

MDR-8651649
FY86 $568,830
FY88 $372,863
Mathematics

"Used Numbers: Collecting and Analyzing Real Data

Data analysis can provide a powerful and relevant approach to teaching key mathematical skills to elementary school children. It provides a meaningful context for the use of computation skills. It involves students directly with important mathematical ideas that are applicable to science, social science, and problem solving. It is a vehicle for bringing real applications of mathematics into the classroom. It is a topic that is familiar to teachers. And calculators and computers provide tools for collecting and analyzing data in the classroom that previously have not been available.

This project will develop recommendations, prototype materials, and calculator and computer activities to be infused into a new K-6 curriculum strand on data analysis. The materials will emphasize age-appropriate data analysis skills such as counting, comparing, classifying, looking for patterns, finding central tendencies and variation, and predicting trends.

This project will target a broad range of students, especially those who have historically been underserved (girls, minorities, and disadvantaged students). Project materials will reach approximately 10,000 teachers through a network that will distribute a newsletter as well as the student materials. Videotapes will be produced for use in teacher education.

RESEARCH IN TEACHING AND LEARNING

Susan J. Russell
Janice R. Mokros
Technical Education Research Center
Cambridge, MA

MDR 8851114
FY88 $89,977
FY89 $97,272
Mathematics

"Constructing Concepts of Average"

The goal of this project is to examine how people develop, construct, interpret, and represent concepts of central tendency, or average. From this understanding, more effective directions for the teaching and learning of statistics at the elementary and middle school levels will be derived. Given the major educational thrust toward statistical literacy for all, and given the clear lack of research on what children understand about statistics, this study represents an important step in linking research to emerging mathematics teaching practices.

During the first year of the project, fourth, sixth, and eighth graders as well as teachers of these grades will be interviewed to determine how they find and interpret average. Participants will use a variety of materials to solve and represent problems involving engaging, familiar, quantitative data. Analysis of these interviews will identify the concepts, approaches, misconceptions, representations, and rules exhibited by individuals at these ages. A theoretical model of conceptions of average will be constructed from the first year's analysis. Based on this model, a series of teaching interviews, using concrete and software-based representations, will be devised. The second year's research will focus on investigating how inadequate cognitive models of average can become more complete and flexible.

APPLICATIONS OF ADVANCED TECHNOLOGY

Robert F. Tinker	MDR 8319155
Technical Education Research Center	FY84 $928,004
Cambridge, MA	FY85 $ 17,220
	FY86 $441,770
	FY87 $305,328
	FY88 $144,887
	MidSch Science

"Development of Microcomputer-Based Laboratory Instructional Materials"

This project seeks to develop a range of microcomputer-based laboratory materials for general science courses in the middle school (grades 7, 8). The material, hardware and software, will be tested in representative classrooms and modified on the basis of formative field testing. An extensive summative evaluation will be undertaken to test the effectiveness of the materials. The effort will be supported by applied cognitive research. The results will be disseminated through publications, newsletters, symposia, workshops, and commercial distribution.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Robert F. Tinker	MDR 8652120
Technical Education Research Center	FY87 $ 737,774
Cambridge, MA	FY88 $1,085,366
	FY90 $ 300,000
	Elem Science

"National Geographic Kids Network Project"

The National Geographic Kids Network Project is a series of exciting, flexible elementary science units featuring cooperative experiments in which students in grades 4-6 share data nationwide using telecommunications. Topics will involve students in issues of real scientific, social, and geographic significance. Combining basic content from typical school curricula and guided inquiry learning, the Network Project can be used to supplement textbooks and existing materials or to form complete year-long science courses.

Technical Education Research Centers will produce six units and software for sending, processing, and displaying data. The National Geographic Society will develop at least four additional units, publish all the materials, and provide teacher development assistance. Materials and telecommunications will be designed for practicality in partnership with experienced classroom teachers and administrators. The telecommunications will be software-controlled for ease of use and reliability. The National Geographic Society and a network of professional organizations, state education agencies, and museums will widely disseminate information about the program. Local support and technical assistance will be generated through industry members of the Triangle Coalition for Science and Technology Education, school boards, and community groups.

Refinements to the project will include the addition of electronic mail and electronic bulletin board functions that will foster creativity and encourage kids and teachers to develop their own experiments as follow-ons to the organized activities. Also, the project is creating several good opportunities for research into how girls' participation in science can be supported, how children learn, and how teacher training and support can be delivered via telecommunications networks.

APPLICATIONS OF ADVANCED TECHNOLOGY

Robert F. Tinker	MDR 8550373
Nancy Roberts	FY86 $349,976
Technical Education Research Center	FY87 $149,280
Cambridge, MA	MidSch Science

"Modeling: Instructional Materials and Software for Theory Building"

The goal of this project is to give students in grades 7-12 tools and materials to understand complex systems. Students will be able to create models of complex situations and evaluate the correctness of their models using empirical data. In short, they will be able to build and test theories, and apply these skills to the sciences.

This goal will be accomplished by a three-phase project to develop powerful, fast software packages with good user interfaces that allow easy model creation and testing, together with a sequence of instructional material using this software. This project funds the first phase of this effort during which prototype software and material will be developed, tested and published. The resulting curriculum materials will be widely disseminated through newsletters, symposia, teacher workshops, professional presentations and commercial publication.

The material will be developed by Technical Education Research Center (TERC) with the collaboration of leading educators and area schools.

FACULTY ENHANCEMENT PROGRAM

George S. Mumford	USE 8854201
Tufts University	FY88 $46,333
Medford, MA	Astronomy

"Workshop for Instructors of Introductory Astronomy"

Portable equipment and other relatively inexpensive devices can be used to stimulate student interest in Astronomy provided that the instructor has the appropriate background. This workshop is particularly for faculty who teach Introductory

Astronomy courses but who have had limited professional training in the field. These instructors, at both 2- and 4- year colleges will participate in a two-week workshop involving various activities that illustrate the methods of Astronomy and that will enhance undergraduate teaching programs.

Through the Center for Science and Mathematics Teaching, new technologies will be introduced, while in other daily sessions participants will be actively involved in the type of exercises they might use with their students. Two field trips are planned: to introduce participants to certain aspects of radio astronomy; and, at night, as a follow-up to a session on astrophotography. In four evenings scientists at Tufts will discuss their current research in relevant fields.

In addition to the NSF funds, participants will contribute about 10% in travel expenses toward the cost of operation of the project.

TEACHER PREPARATION PROGRAM

Ronald K. Thornton
Tufts University
Medford, MA

TPE 8751481
FY88 $112,924
FY90 $ 36,609
MidSch Science

"Tools for Scientific Thinking: Microcomputer-Based Laboratories for Teaching Science Teachers"

This project will be designed to educate participants to become aware of how different teaching methods affect student understanding of selected science concepts. Building on teacher interest in doing classroom research, the STAR model will bring teachers to a summer workshop where they will become part of a classroom research team. In order to study how teaching methodology effects learning, the middle school teachers in this project will need to acquire a deep understanding of the science topics to be investigated, strategies for teaching for conceptual change, and methods for determining levels of student understanding. The first year's inservice and academic year follow-up will deal with selected physics topics and the conceptual change teaching model. During the second year, leaders from twenty-five school systems will receive instruction so that they can conduct similar projects in their own systems. Years three and four will involve expanding the model to the life and earth sciences. During year five, a guide for developing such inservice programs will be produced and disseminated.

NETWORKS PROGRAM

Judith A. Kelley
Stephen J. Gerome
Elaine Adams
Marilyn O'Brien
University of Lowell
Lowell, MA

TPE 8751372
FY87 $40,433
Communications

"MVSTSN - A Strategy for a Workshops/Computer Conferencing Teacher Network Support Group"

The primary goal of this project is to evaluate the effectiveness of linking computer conferencing and workshops as a strategy to reinforce and motivate teachers to put to use in their classrooms and laboratories what they learn in workshops, to encourage teachers to develop modifications of ideas and methods they have been exposed to in workshops, and to stimulate the creation and sharing of new ideas among teachers.

Those participating in the study are science teachers in the Merrimack Valley of Massachusetts teaching in public schools, private schools, and colleges. This mix of participants, collaborating as equals and colleagues, is a special feature of this study.

The outcome of this project will be useful information, both for those who give workshops and for those seeking to foster the use of computer conferencing among teachers. The project's successful conclusion will have broad application as a useful model for the collaboration of science teachers.

RESEARCH IN TEACHING AND LEARNING

John J. Clement
University of Massachusetts Amherst
Amherst, MA

MDR 8751398
FY88 $153,915
FY89 $157,488
FY90 $168,177
Physics

"Strategies for Overcoming Misconceptions in Science"

There is now a significant body of literature documenting misconceptions harbored by science students which are quite widespread and which are surprisingly resistant to change during instruction. For many students, such misconceptions are critical barriers which prevent the attainment of conceptual understanding. This project will investigate some promising strategies for overcoming misconceptions in high school physics courses. The project will: (1) conduct research on students' misconceptions and potentially useful physical intuitions; (2) develop innovative lessons for dealing with several specific misconceptions in mechanics; (3) evaluate their effectiveness in high school classrooms; (4) conduct tutoring experiments in order to study student learning processes in detail and to compare alternative teaching methods;

(5) formulate general principles of instruction for dealing with misconceptions in physics with possible applications to other areas of science and mathematics. Research that leads to such principles for instruction is seen as essential for guiding the national development of effective new course materials and software for students and teachers. The project will be carried out by a team of high school teachers and researchers who have worked together to produce innovative lessons and research studies. Thus, the project will be working directly at the interface between the science education research community and the classroom.

TEACHER PREPARATION PROGRAM

Jack Lochhead TPE 8751491
University of Massachusetts Amherst FY87 $118,787
Amherst, MA FY88 $228,699
FY89 $139,086
General Sci Educ

"A Constructivist Approach to Science Education"

The University of Massachusetts at Amherst will create within the general education context a series of courses that will provide education majors with a comprehensive constructivist perspective concerning science and mathematics instruction. Because the courses that will be designed are intended for a broader audience than the education major, not only will students of other majors reap the benefits of this epistemological approach, but the education majors will have the experience of being taught as they should teach.

The individual components of the project consist of the modification and/or development of (1) a faculty seminar on constructivism, (2) a basic mathematics course, (3) an undergraduate course on the learning of mathematics and science, (4) an interdisciplinary science laboratory course, and (5) an interdisciplinary science course. To accomplish these tasks an interdisciplinary team of eight scientists and mathematicians, two educators, and two teachers will study recent developments in the theory of science learning and apply them to the construction of the new courses.

TEACHER PREPARATION PROGRAM

Jack Lochhead TPE 8850402
University of Massachusetts FY88 $40,035
Amherst, MA Other NEC

"A Planning Conference: Science Courses for Teacher Preparation"

The University of Massachusetts will plan and convene a small invitational conference to stimulate science and mathematics department faculty at major research universities to become actively involved in the scientific preparation of teachers by redesigning introductory science and mathematics courses. The conference will seek to produce collaboration among scientists, mathematicians, educators, and cognitive scientists in modernizing course content, incorporating recent educational research results, and in the case of science courses, providing opportunities for hands-on experiences. If the conference is successful, the result should be the development of introductory science courses in which elementary education majors and liberal arts majors will gain a better understanding of science concepts and the nature of scientific inquiry. Cost sharing for the conference by the University of Massachusetts is 20%.

APPLICATIONS OF ADVANCED TECHNOLOGY

Beverly P. Woolf MDR 8751362
Edwina P. Rissland FY87 $266,967
University of Massachusetts FY88 $281,239
Amherst, MA FY89 $273,925
Computer Science

"Tools for Tutorial Conversation: Improving Science Education through Heuristic Simulation Tutors"

The focus of this project is building a mechanism for managing intelligent tutoring discourse and on automating the process of transferring such knowledge from teachers to the tutoring system. The first research area focuses on problems of dialogue management for science education and implements a discourse framework - a virtual machine - that enables tutoring feedback in the form of examples, analogies, and simulations within interactive simulations. The virtual machine is being implemented within simulations that allow a student to test his/her hypothesis about domains such as physics and astronomy, specifically static dynamics and celestial mechanics.

The second component of this work is automation: the process of transferring knowledge from experts, such as teachers, psychologists, and curriculum developers, to the intelligent tutors. The project seeks to build programming-free tools for representing tutoring strategies, domain knowledge, and intervention tactics. These tools are designed to assist teachers in visualizing their science knowledge in a form amenable to Artificial Intelligence systems and in encoding this knowledge in the form of examples, analogies, or remediation techniques.

An FY88 supplement to this grant allows the extension of this project to employ a faculty member from an institution with limited research opportunities, who has a background in artificial intelligence and in science and mathematics education, particularly involving minorities. This faculty member will organize and direct an institute on intelligent tutoring systems for teachers and will involve minority public school students and teachers in this important area of research.

TEACHER ENHANCEMENT PROGRAM

Maurice Eash
William G. Hagar
Martin Posner
Walter E. Weibrecht
University of Massachusetts Boston
Boston, MA

TPE 8751796
FY88 $392,638
Chemistry

"Applications of Basic Science in Industry and Society to Enhance Secondary School Science"

This project provides an opportunity for secondary school biology and chemistry teachers to learn and use basic science concepts and theories as employed in industry for developing curriculum units. The project is predicated on the thesis that a curriculum that is developed by teachers from direct experience will induce changes more quickly in new teaching strategies and produce more highly motivated students and a greater understanding of science.

Visits to industries and science agencies are organized to provide direct experience to teachers. These visits will be supplemented by lectures and laboratory work conducted by university staff paired with experienced high school science teachers. Three-week summer workshops in chemistry and biology will be held during the summers of 1988 and 1989. The activities will continue with 12 meetings during the academic year.

This project will assist in determining if familiarity with equipment and practical applications of theories and concepts in applied settings will build motivation for pursuing science careers.

COLLEGE SCIENCE INSTRUMENTATION

Barbara S. Beltz
Beverly A. Blazar
Wellesley College
Wellesley, MA

USE 8851888
FY88 $40,742
Biology

"Immunological Techniques in the Undergraduate Laboratory"

Equipment secured through this project is being used to expand the variety of immunological methods taught to undergraduates. Specific goals are (1) to incorporate assays into laboratory sessions to study ongoing immunological activity; and (2) to localize and quantitate antigens in tissues and on cells. Specific methods used are: immunocyto- chemistry, radioimmunoassay, blastogenesis assays, interleukin production, western blots, and 51-chromium release assays. Several major pieces of equipment are crucial to this program: a cryostat, cell harvester, CO2 incubator, gamma counter, sterile benches, -75 degree freezer, and a centrifuge.

Because the methods being introduced encompass several disciplines, specific laboratory experiments using this equipment involve a variety of courses that will affect approximately 1,250 students over the next five years. The exercises developed as part of this program will enhance the sophistication of the overall experience available to these undergraduates in an important new area of Biology, providing them with a deeper understanding of the immune response and of the uses of immunological techniques to detect molecular change. This area has grown exponentially in the last two decades. Both clinically and experimentally, new assays have made it possible to localize and quantitate molecules heretofore unknown.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

William F. Coleman
Wellesley College
Wellesley, MA

USE 8852245
FY88 $24,300
Chemistry

"Purchase of Fluorescence Spectrometer in Undergraduate Education"

A Fluorescence Spectrometer and accessories is being used in upper-division teaching and in student research. The instrument is being used in laboratory courses in Inorganic and Analytical Chemistry, and in undergraduate research projects in Inorganic Chemistry, Biochemistry, Physical Chemistry and in joint projects with members of the Biological Sciences Department. In the teaching laboratories experiments have been designed to use fluorescence to measure rates of fast reactions and to illustrate the use of fluorescence as an analytical tool. Research uses are in projects dealing with the photophysics of metal complexes, membrane properties of a particular class of cyanobacteria, measurement of crosslinking in membrane research and the equilibration between photosystems I and II in plants.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Theodore W. Ducas
Wellesley College
Wellesley, MA

USE 8750777
FY87 $34,883
Physics

"Lasers and Other Instrumentation for Modern Spectroscopic Laboratories in the Undergraduate Physics Curriculum"

The project entails the coordinated introduction of modern spectroscopy laboratories into the Wellesley physics curriculum. The instrumentation will be used in the sequence of student work that includes the modern physics course, a new advanced laboratory course and student research projects. The requested system includes a nitrogen laser and high resolution dye laser, a boxcar integrator, a broadband light source, a spectrometer and lock-in amplifier, detectors and data handling electronics. It is designed to be flexible enough to handle the range of spectroscopic topics that will be covered in the associated courses. The pulsed dye laser will be used to study atomic structure, and the broadband light source will enable students to look at simple quantum structure in solids. In the subsequent advanced course, the lasers, spectrometer and boxcar will be employed for more sophisticated studies of structure and decay in atomic and condensed matter systems and of nonlinear effects. Detailed investigations of excitons and the band structure of solids will be made with the spectrometer and lock-in amplifier. This work will correspond closely to the material covered in the Applications of Quantum Mechanics course. Students will then be able to use the same system and the skills they have acquired in their research and honors projects while working with professors who taught them earlier courses. This instrumentation represents a major step in the upgrading of the physics major at Wellesley. The overlap of skills and interest on the part of the participating faculty makes it particularly appropriate and assures continuity in its implementation.

COLLEGE SCIENCE INSTRUMENTATION

Mohammad Khosrowjerdi	USE 8750738
Western New England College	FY87 $40,464
Springfield, MA	Mechanical Eng

"Computer-Aided Design Hardware and Software for Integration of CAD into the Undergraduate Mechanical Engineering Curriculum"

Under this project, computer aided design will be integrated into the mechanical engineering curriculum. The laboratory will be built around the Tektronix 4125 and 4129 color graphics workstations with graphics terminals. These in turn will be networked on a Data General MV 4000. Among the improvements planned are: the incorporation of solid modeling techniques into the freshman engineering graphics, kinematic movements of linkages, thermal analysis using ANSYS, the analysis of beams using an in-house developed package, and the use of ANSYS as an analytical tool in experimental data analysis. It is expected that the laboratory will impact all four years of the students training through various exercises.

INFORMAL SCIENCE EDUCATION

Paula S. Apsell	MDR 8751813
Graham Chedd	FY88 $500,000
WGBH Educational Foundation	Biology
Boston, MA	

"LIFE: Cracking the Code (an Eight-Part Prime-Time Television Series for Broadcast on PBS in the Fall of 1990)"

WGBH Boston and its NOVA production group will produce a series of eight one-hour television programs titled "Life: Cracking the Code". The series will cover recent advances in molecular biology, the record of personal quest and achievement of many of the biologists who have contributed to these advances, the social costs and benefits that have resulted, and the ethical questions that new knowledge and new abilities in biology have generated. Individual programs will include "The Language of Life" on the discovery of DNA's role in molecular biology; "Molecular Machines" on proteins; "Designing the World to Order" on practical consequences of the new biology; "When Cells Rebel" on the processes involved in cancer; and "Between Self and Other" on the immune function.

The series will be produced for prime time PBS evening broadcast to an audience of more than twelve million individuals by a co- production by the NOVA science unit at WGBH and the Chedd-Angier Production Company. Scientific advice and consulting will be provided by Harvard's Whitehead Institute for Biomedical Research and a project advisory committee composed of seven distinguished scholars chaired by Prof. David Baltimore. The series production budget will be approximately $4.2 million.

This new science series on DNA, molecular biology and its new technologies will cover one of the great intellectual achievements of our time. It will provide timely information about an area of scientific discovery that is rapidly transforming many aspects of our life. The series will, in addition, document the rich recent history of molecular biology with the participation of many of the original researchers who are still alive and active in their fields.

INFORMAL SCIENCE EDUCATION

Robin Bates	MDR 8751407
WGBH Educational Foundation	FY87 $50,000
Boston, MA	Astronomy

"SUPERNOVA: A Film within the NOVA Series"

The WGBH Educational Foundation and the NOVA production team will produce an hour-long special program in the NOVA series on the remarkable scientific response to Supernova 1987A, the most significant supernova to be observed since 1604. Responding rapidly to this unique opportunity, they will capture the spirit of science information, through video and audio interviews with many of the involved research scientists in their laboratories and observatories around the world during the critical time period when there are as many questions as answers about the event. They will continue to cover the scientific response into the summer and early fall, including scientific meetings that are expected to provide clarification and explanation of the supernova's behavior.

They are responding with insight and speed to a rare opportunity, and will match National Science Foundation funds with $300,000 of their own production funds to produce this program. NSF support will be used to insure that the coverage and treatment of the event will be substantive and accurate, and rich enough in detail to illustrate the processes of scientific discovery, research cooperation, and debate and dialogue that leads to understanding.

The resulting program will be seen by the more than 12 million viewers of the NOVA series, as well as by tens of thousands of classrooms in high schools and colleges. Educational materials will be produced to accompany the program.

COLLEGE SCIENCE INSTRUMENTATION

Edmund Y. Tong
Wheaton College
Norton, MA
USE 8852416
FY88 $17,370
Biology

"Microcomputer-Controlled Instrumentation for an Undergraduate Physiology Laboratory"

Although the implementation of computer use in undergraduate education had successfully permeated every facet of this department's curriculum, the microcomputer application to data acquisition and analysis had not yet been initiated systematically. Outdated physiological instruments had started to become a hindrance to the full development of the instructional program. With equipment provided through this project, the faculty is revising and upgrading the student work stations with microcomputer-interfaced instrumentation.

Modernization of the Introductory Physiology laboratory benefits many related upper-level courses. Students are able to engage in hands-on experimentation with improved quality and quantity. They also gain easier access to computer simulations and computer-aided lessons. Furthermore, they have a chance to learn and master state-of-the-art techniques in data acquisition and analysis. Finally, the new instrumentation permits new experiments and research projects to be developed for independent research and senior honors work, an important part of the institution's ongoing efforts to provide its women a strong basic science foundation for graduate studies and subsequent careers in science.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Bryce A. Babcock
Williams College
Williamstown, MA
USE 8852643
FY88 $25,869
Computer Science

"Robotics Lab for Non-Science Majors"

This project introduces undergraduate non-science majors to topics in science and technology through a laboratory experience involving robotics. The equipment supporting this project includes: Rhino Robot mobile and articulated arm robots, pneumatic actuators, ultrasonic ranging devices and visual imaging systems. Laboratory exercises are designed to introduce students to various reference frames, linear and rotational motion, concepts of work, energy and power, feedback control and various sensing devices.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Stuart B. Crampton
Williams College
Williamstown, MA
USE 8851881
FY88 $32,690
Physics

"Instrumentation for Precision Time Transfer in Undergraduate Physics and Astronomy Laboratories"

The Department of Physics and Astronomy will purchase equipment to receive and study time and frequency signals from Global Positioning Satellite transmitters. An existing atomic hydrogen maser frequency standard will provide a stable frequency reference for comparing signals from different satellites and for comparing via computer link the satellite signals received at Williamstown, MA, and at the National Bureau of Standards in Boulder, CO. Applications to navigation and solar system ranging and to time and frequency transfer between remote sites will illustrate the power of this new technology and its value to science. The telemetry technology will itself be studied using the receiver's own diagnostic displays. Special teaching laboratory modules using this equipment will illustrate the fundamental properties of space and time that students in Introductory Physics courses have been learning in class and will introduce them to state-of-the-art technology. The equipment will provide a basis for a new course designed to introduce students not intending a science major to modern notions of space and time and their relationship to modern technology. The equipment will also be used by Senior Honors and other students doing research projects with our experimental low temperature atomic hydrogen maser.

In addition to NSF support, participants will contribute approximately an additional 15% toward the costs of the program.

COLLEGE SCIENCE INSTRUMENTATION

David P. Dethier	USE 8750838
Henry W. Art	FY87 $27,723
Williams College	Environmental
Williamstown, MA	

"Meteorologic and Hydrologic Instrumentation for Undergraduate Field Work"

Meteorologic and hydrologic instrumentation will be used to improve field laboratories and computer studies in Geology and Biology courses at Williams College. The instruments will be used at a weather station in Hopkins Memorial Forest, an experimental forest managed by Williams College, and the focus of field classes and independent research in the environmental sciences. The sensors and data loggers will be installed at the existing weather station, and three portable meteorologic and hydrologic stations will be assembled for use at remote sites. Use of state-of-the-art instruments which encode data in digital format will permit easy transfer of weather and hydrologic data to computer files.

Portable instrumentation will significantly improve the quantity and quality of data collected in the field and used in required courses such as Geomorphology, Environmental Biology, and Communities and Ecosystems. Computer files of weather and hydrologic data will also be used to develop new field and computer labs in elective courses such as Weather and Climate and Computers in Geology. Biology and Geology majors most likely to go to graduate school, those students involved in field studies for senior honors theses, will gain invaluable experience using modern instrumentation and computer reduction of data from their field sites.

COLLEGE SCIENCE INSTRUMENTATION

Paul Karabinos	USE 8852375
Williams College	FY88 $16,898
Williamstown, MA	Geology

"Instrumentation for Mineral Separation and U-Pb Geochemistry Laboratories for Undergraduates"

This institution will purchase equipment to establish mineral separation and uranium-lead geochemistry laboratories. These laboratories will be used for undergraduate research projects in geochronology, and to improve instruction in several undergraduate Geology courses. The mineral separation equipment will be used to concentrate heavy minerals from sediments and sedimentary rock and to isolate fossils in courses in geomorphology, paleontology, and sedimentology. Together with the equipment for carrying out U-Pb geochemistry it will be used in courses in tectonics and geochronology to illustrate the principles of isotopic dating.

The NSF award will be matched by an equal amount from the grantee. In addition, the grantee is providing funds for building renovation to accommodate the new equipment.

FACULTY ENHANCEMENT

Jay M. Pasachoff	USE 8854224
Williams College	FY88 $14,000
Williamstown, MA	Astronomy

"Support for IAU Colloquium on the Teaching of Astronomy"

International Astronomical Union Colloquium of Astronomy will be held during July 27-31, 1988, at Williams College in Williamstown, Massachusetts. It will be the first IAU colloquium on teaching ever held. The colloquium will take place immediately prior to the International Astronomical Union's General Assembly in Baltimore, the first time the IAU has met in the United States since 1961. The Colloquium on Teaching will bring together about 100 American/Canadian astronomers with 100 astronomers from all over the world. The benefit to American teachers of astronomy from interaction with their counterparts from all over the world will be extensive.

The grant will assist with some participant costs which are above those necessary to attend the General Assembly.

CAREER ACCESS OPPORTUNITIES

John M. Wilkes	8818831
Worcester Polytechnic Institute	FY88 $539
Worcester, MA	Other NEC

"Support of National Undergraduate Student Projects Competition in Science, Technology, and Society"

This award will enable the winner of the Second National Student Projects Competition in Science, Technology and Society (STS) to travel to the international meeting of the Society for Social Studies of Science (4S) in order to receive the award and present the research project for which it was given. The meeting will be held November 16-19, 1988, in Amsterdam. The first competition was held in association with the 4S meeting in Worcester, Massachusetts in 1987. From 47 student entries, a top prize and three second prizes were awarded. The event was successful and the project sponsors, Worcester Polytechnic Institute and the 4S, decided to continue this effort to introduce promising young talent to the review process and provide a forum for development of both written and oral communication of research findings. The ultimate goal is to institutionalize an international, biennial competition for the best undergraduate paper in science, technology and society studies.

This project is co-funded with the NSF Directorate for Biological and Behavioral Sciences.

MICHIGAN

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Elizabeth L. Moore
Mathematics
Saline Middle & High Schools
Saline, MI

Kathleen M. Scullen
Science
Novi Middle School
Novi, MI

1988

Valerie L. Mills
Mathematics
Ypsilanti High School
Ypsilanti, MI

Alan M. Gibson
Science
Rochester Adams High School
Rochester, MI

COLLEGE SCIENCE INSTRUMENTATION

Willard L. Craft	USE 8750399
Adrian College	FY87 $29,630
Adrian, MI	Chemistry

"Increased Access to High Quality NMR Spectra"

A computer-interfaced Nuclear Magnetic Resonance Spectrophotometer together with a computer-controlled Spectral Bulletin Board are being used by the Chemistry Department at Adrian College to achieve the following goals: provide Adrian students with access to high quality NMR spectra for spectral interpretation, quantitative analysis of mixtures and reaction rate determinations; and provide access to high quality NMR spectra for faculty and students at other schools throughout the nation. These spectra are available either by sending diskettes through the mail or by telephone access using modems to the Adrian Spectral Bulletin Board.

COLLEGE SCIENCE INSTRUMENTATION

Craig Weatherby	USE 8750442
Adrian College	FY87 $7,977
Adrian, MI	Biology

"Computer-Aided Radio Telemetry Equipment for Undergraduate Studies in Animal Behavior and Ecology"

Laboratory experiences are being introduced to illustrate and test theories of animal behavior and ecology that are presented in the lectures of five existing courses. The computer-aided radio telemetry equipment also is providing advanced undergraduate research opportunities in the disciplines of ethology and ecology, providing undergraduate access, experience, and familiarity with the equipment.

The animal behavior and ecology topics that are being developed for incorporation into the Department's laboratory course work and undergraduate research include home range, territoriality, habitat preferences and partitioning, cyclic activity patterns (circadian and seasonal), dispersal patterns, refugia selection, social organization, and the effects of age, season, and sex on any or all of the above.

COLLEGE SCIENCE INSTRUMENTATION

Craig A. Weatherby	USE 8851477
Adrian College	FY88 $22,174
Adrian, MI	Biology

"Equipment for an Undergraduate Program in Animal Behavior Communication and Ecology"

This project is enhancing the capability of the Biology Department to provide laboratory experiences which illustrate and test theories of animal behavior, communication, and ecology that are introduced in the lectures of six existing courses. In addition, it provides advanced undergraduate research opportunities in the disciplines of Animal Behavior, Communication, and Ecology; upgrades the animal behavior and ecology facilities (radio telemetry) currently existing at this institution, and adds to existing animal behavior and ecology facilities an important ability to analyze animal communications. With it, undergraduates have ready access to state-of-the-art, computer- interfaced sound spectrographic and video taping equipment for the analysis of animal communication.

All this enhances the undergraduate Biology majors' opportunities to become researchers at the entry level and to increase these skills at the independent research level. The Department is conducting a special program for recruiting talented minority members into this sequence.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Robert E. Dininny USE 8750716
Albion College FY87 $34,435
Albion, MI Chemistry

"Instrumentation for an Integrated Undergraduate Laboratory Program"

The Chemistry Department at Albion College has based its efforts in curriculum development and the preparation of instructional materials on the premise that a chemistry curriculum should: (1) be designed for the specific students it serves; (2) serve majors and non-majors equally well; (3) provide maximum flexibility; (4) reflect current practice in chemistry and chemical education at all levels of the curriculum, both in the classroom and the laboratory. Current laboratory practice dictates the involvement of students with modern instrumentation, an outcome which is being enhanced by the recent acquisition of a nuclear magnetic resonance (NMR) spectrometer. This instrument is being utilized by students in laboratory courses in organic chemistry, advanced laboratory instrumentation, and advanced laboratory projects. In addition the availability of the NMR broadens the range of possibilities for student research projects.

COLLEGE SCIENCE INSTRUMENTATION

David W. Kammer USE 8852986
Albion College FY88 $5,835
Albion, MI Computer Science

"Course Improvement in Artificial Intelligence and Robotics"

This project supports undergraduate education in Artificial Intelligence and Robotics at this institution. A high quality, modern course is offered in a liberal arts context so that students become knowledgeable in a field that is critical to the Nation's manufacturing systems.

The equipment that supports this project includes: a high-speed dedicated computer system with image digitizer, TV camera, robot arm and expert systems, and robotics software.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

James R. Hutchison USE 8852717
Alma College FY88 $27,711
Alma, MI Chemistry

"Computer Interfaced Experiments for General Chemistry and Physical Chemistry Laboratories"

Computer interfaced experiments are being introduced into the General Chemistry and Physical Chemistry laboratories. Six experiments are being introduced into General Chemistry involving computers interfaced with sensors for the gathering of experimental data. Temperature probes, colorimeter interfaces or pH meter interfaces designed by project SERAPHIM staff are being used. Lotus 1-2-3 and Lotus Measure are serving as templates at the introductory level. Experiments include chemical kinetics; calorimetry and heat of reaction; molecular weight from freezing point depression; computer driven titration to measure equilibrium; gas chromatography; and statistics and error analysis. In Physical Chemistry the students are doing advanced aspects of some of these same experiments as well as using the computers for analysis atomic and molecular orbitals through display of wave functions and the consideration of changes in bond length.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Ronald L. Blankespoor USE 8851202
Calvin College FY88 $65,600
Grand Rapids, MI Chemistry

"Integration of Fourier Transform - Nuclear Magnetic Resonance Spectroscopy into an Undergraduate Curriculum"

A 200 MHz Gemini Fourier Transform Nuclear Magnetic Resonance (FT-NMR) Spectrometer is being integrated into the undergraduate Chemistry curriculum for chemical analysis. Chemistry laboratory instruction is being improved in six regularly offered courses, one interim course, and the undergraduate research program of the department. Students are being introduced to the FT-NMR in the sophomore Organic Chemistry course and receive hands-on experience with this state-of-the-art, computer-controlled laboratory instrument as juniors and seniors. The high-field NMR technique produces simplified proton NMR spectra allowing for a more thorough interpretation of spectra by the students and thereby enhancing their ability to use NMR in the identification of compounds they have prepared. They are also becoming familiar with Carbon-13 NMR as an important tool for structural elucidation of substances. Computer control of the instrument is allowing for collection, manipulation, and rapid analysis of data including two- dimensional NMR.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Hari B. Bidasaria
Central Michigan University USE 8750078
Mount Pleasant, MI FY87 $37,300
Computer Science

"An Undergraduate Laboratory in High Resolution Graphics and Image Processing"

A high resolution computer graphics and image processing microcomputer laboratory is being set up. Using IBM PC/AT's as workstations connected by a local area network to a Cyber 170 computer, students will be able to apply various techniques of solid modeling, shading, animation and surface texturing. A slow-motion video tape recorder will be used to record images a frame at a time, which, when played back at normal speed will give the sensation of motion.

COLLEGE SCIENCE INSTRUMENTATION

Bob A. Howell
Central Michigan University USE 8852049
Mount Pleasant, MI FY88 $34,850
Chemistry

"Nuclear Magnetic Resonance (NMR) Spectroscopy in the Undergraduate Curriculum"

The reestablishment and enhancement of a quality exposure to NMR spectroscopy for chemistry undergraduates is being carried out in this project. Students in Organic Laboratory, Polymer Laboratory and undergraduate research are being trained to meet previously established performance objectives. These include a sound knowledge of methods and instrumentation, hands-on operation of the instrument and the utilization of NMR spectroscopy for structure determination, characterization of dynamic equilibria, determination of optical purity and observation of reaction rates. This training forms an integral part of a successful instructional program designed to adequately prepare students for a career in industry or for graduate research in Chemistry. To enhance this training, major new development of instruction in the Organic Chemistry Laboratory, Physical Chemistry Laboratory and Polymer Science Laboratory are under way.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Sadali N. Jayaramamurthy
Central Michigan University USE 8852142
Mount Pleasant, MI FY88 $27,619
Computer Science

"Digital Image Processing Laboratory "

This project supports a Digital Image Processing course in a state where expertise in this technology is in critical need. The laboratory supporting the project includes a VAX station II/GPX running the Ultrix-32 operating system. The Vax station controls diskless monochromatic workstations connected via ethernet that serve as student workstations. Image acquisition is accomplished via a Panasonic WV-D50 solid state black and white camera, a frame grabber and a frame processor. Using the laboratory, undergraduate students gain hands-on experiences using hardware/software image processing tools.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

David J. Matty
Central Michigan University USE 8750320
Mount Pleasant, MI FY87 $28,750
Geology

"Courses and Development of a New Course in Analytical Scanning Electron Microscopy and Image Analysis"

Students in geology and biology have been using electron microscopy for morphological studies of biological and geological materials. By adding a quantitative microanalysis system with digital X-ray and video image processing and analysis systems the students are being exposed to state-of-the-art analytical and image processing. A new course is being developed between the biology and geology departments to focus on the underlying theory and diverse applications of analytical scanning microscopy and image processing analysis. Students are receiving hands-on experience through extensive laboratory work. In addition students in mineralogy and petrology are doing new experiments that are made possible by the expanded system. The quantitative microanalysis software is making it possible for the students to do Bence-Albee analyses for geological samples and to do statistical and mathematical analyses for least-squares filter fit, intensity ratio calculations and multiple point analysis.

COLLEGE SCIENCE INSTRUMENTATION

Ishwar Rattan
Central Michigan University USE 8851239
Mount Pleasant, MI FY88 $14,310
Computer Science

"Operating Systems Laboratory Using Microcomputer Based Workstations"

This project permits undergraduate students in the Computer Science program to have a practical laboratory experience associated with the study of operating systems. The equipment that supports the project includes fifteen Zenith microcomputers running the MINIX operating system. Using the source code of this operating system, students gain a hands-on experience in modifying the operating system.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Daniel E. Wujek USE 8851238
Central Michigan University FY88 $66,321
Mount Pleasant, MI Geology

"Expanded Scanning Electron Microscopy Instruction for Undergraduates"

Students in an ongoing course are introduced to the full range of capabilities of a modern scanning electron microscope and students in the Mineralogy and Petrology courses learn of these capabilities through several laboratory exercises. In a new course, students receive hands-on experience with state-of-the-art equipment through extensive laboratory work. Their level of background in areas of transmission electron microscopy and scanning electron microscopy enable the students to present more favorable credentials to prospective employers. Further, students have the technical capabilities that allow them to pursue goals in either graduate school or medical school research.

The grantee provides funds for this project that more than match the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Theodore P. Aufdemberge USE 8750082
Concordia College FY87 $6,948
Ann Arbor, MI Environmental

"Computerization of Concordia's Introductory Physics/Earth Science Laboratory"

Concordia College will improve the quality of physics and earth science instruction by introducing computer controlled experiments. These will increase the accuracy and precision of data gathered in experiments, and speed the calculations needed to convert raw data into usable data, so that the time normally spent on these activities can instead be used in analyzing the data and drawing conclusions. The major purchases will be two Apple computers, interface cards, sensors, a printer, and a plotter to provide hard copies of the data gathered and manipulated. The sensors will be used to measure time intervals, temperatures, frequencies, and weather phenomena.

Most of the students taking physics and earth science courses at Concordia are studying to become elementary and secondary school teachers.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Kenneth Hill MDR 8550030
Detroit Area Pre-College FY85 $174,314
Engineering Program, Inc FY86 $143,444
Detroit, MI FY87 $231,921
FY88 $109,000
Mathematics

"Pre-Engineering Curriculum Guide and Supplemental Mathematics Materials Development"

The Detroit Area Pre-College Engineering Program, Inc. (DAPCEP) is a community-based, non-profit corporation whose major objective is to increase the number of Blacks, Hispanics, and Native Americans who choose engineering and technical careers. The Program works cooperatively with the Detroit Public Schools and with six universities: Michigan State University, Oakland University, University of Detroit, University of Michigan at Ann Arbor, University of Michigan at Dearborn, and Wayne State University. More than 20 corporations from the greater Detroit area also contribute financially and intellectually to DAPCEP.

In this project, DAPCEP will undertake two activities designed to increase the number of minority students who choose science and engineering careers. Supplementary mathematics materials, which focus on problem solving and on engineering applications of mathematics, will be developed for use by high school students. A curriculum guide, which will introduce middle school students to some of the content, concepts, and procedures of engineering, will be created. These printed materials will be supplemented by videotapes, which will assist teachers in using the materials and will acquaint students with minority role models working in the engineering fields. The materials will be tested and evaluated in the Detroit area. The completed materials will be disseminated nationally.

COLLEGE SCIENCE INSTRUMENTATION

Michael J. Brabec USE 8750458
Eastern Michigan University FY87 $26,490
Ypsilanti, MI Chemistry

"Equipment for Undergraduate Instruction in Toxicology"

Three high performance liquid chromatographs (HPLCs), a Biological Oxygen Monitor (BOM), and a DNA filter elution system (spectrofluorometers and peristaltic pumps), recently acquired by the Chemistry Department at Eastern Michigan University, provide undergraduate students with opportunities to utilize cellular and biochemical technology to study the interactions between chemicals and living systems. HPLC is being used to study the formation of metabolites and identify molecular adducts resulting from exposure to toxic chemicals. The DNA filter elution system allows students to examine changes in DNA integrity introduced by exposure to chemical carcinogens and mutagens. The BOM is being used in the study of subcellular reactions to toxic chemicals. In particular, activities are directed toward the developing field of toxicology, with a focus on understanding basic biochemical and cellular phenomena as well as determining the hazards associated with exposure to toxic levels of chemicals.

COLLEGE SCIENCE INSTRUMENTATION

Mildred Lintner
Eastern Michigan University
Ypsilanti, MI
USE 8852658
FY88 $37,461
Computer Science

"Computer Science Teacher Education Laboratory"

This project uses a specialized computing laboratory to support a Computer Science Secondary Teacher Certification program.

The Computer Science Teacher Education Laboratory includes a mixture of the IBM-PC family as well as Apple II/Macintosh series of computers. Using this collection of equipment, prospective teachers are exposed to hardware and software that is pervasive in industry, business, education and in homes.

The laboratory is used as an integrated applications environment in the curriculum for teachers of Computer Science in the secondary schools. The courses in this program demand extensive and active laboratory experiences in order to prepare prospective teachers for an effective classroom environment.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

John W. Moore
Eastern Michigan University
Ypsilanti, MI
USE 8750324
FY87 $38,464
Chemistry

"Modernization of the General Chemistry Laboratory by Integration of Computer-Based Experiments"

The Chemistry Department at Eastern Michigan University has recently acquired twenty four microprocessors together with sufficient software so that computer-based experiments can be integrated into the general chemistry laboratory. The applications of computers being introduced include interfacing to instrument/sensors for instrument control and data acquisition, simulating inaccessible experiments and atomic-level phenomena, and exploring a chemical database and mathematical models. Utilization of the computers in the laboratory will be continued as students proceed to upper-level courses.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

John W. Moore
Eastern Michigan University
Ypsilanti, MI
MDR 8751262
FY87 $403,604
FY88 $309,046
FY89 $218,210
Chemistry

"Project SERAPHIM: Innovative Chemical Education with Computers"

Project SERAPHIM involves three main functions: clearinghouse for computer-related instructional materials for chemistry; workshop program for teachers of chemistry, and research and development on new kinds of instructional software.

During the past year, with major support from the NSF and contributions from Eastern Michigan University, the project has distributed more than 22,000 diskettes containing SERAPHIM Software and 8,700 written modules on chemistry teaching. The project's mailing list has grown to approximately 10,000. The 1987 Program Contest, co-sponsored by the American Chemical Society Education Division, drew 40 entries and resulted in a dozen new excellent programs. Regional Distribution Centers now number 14 in the United States and 14 in other countries, and SERAPHIM software is being translated into at least two foreign languages. A major effort in the R&D area is the Journal of Chemical Education: Software, whose inaugural issue will appear in July 1988.

Under this current grant, Project SERAPHIM will continue to refine the software which has been developed, conduct workshops, and identify persons as Academic Year Fellows who will develop and disseminate high quality programs. Project SERAPHIM is making a timely and valuable contribution to chemistry education, both in this country and elsewhere. Through the linkages with the American Chemical Society, the establishment of regional distribution centers, and the conduct of self-sustaining workshops, the project should continue for some time to aid in the improvement of the teaching and learning of chemistry.

COLLEGE SCIENCE INSTRUMENTATION

David R. Clark
GMI Engineering and Mgmt Institute
Flint, MI
USE 8851791
FY88 $13,037
Engineering

"Computerized Data Acquisition for Human Factors Laboratory"

This project enhances two undergraduate courses that make use of this institution's existing human factors laboratory. Students using the laboratory experiment with real-time data acquisition in a data-intensive (e.g., 50 to 100 sample/second) environment. Using the data acquisition setup supported by this award, students take many more samples for longer durations than previously possible. The data acquisition system also pre-processes the data from the interfaced human factors devices to give students a greater degree of confidence in their experiments than with manual systems.

The equipment supporting this lab includes networked Apple Macintosh computers (II's and SE's) with A/D interfaces and data acquisition software.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Bhag S. Guru USE 8750931
GMI Engineering & Mgmt Institute FY87 $50,000
Flint, MI Electrical Eng

"Improvement of an Undergraduate Electrical Machines Laboratory"

This project will improve the electrical machines laboratory by adding six well equipped student experimental stations. The stations are to be equipped with "take-apart" machines which will allow the student to understand the physical construction of machines and its relation to physical and mathematical principles. Included in the stations will be most of the common types of machines and transformers. The related experiments will expose the students to both the static and dynamic behavior of electrical machines, and the deviations of dynamic behavior from theoretical performance based on simplifying assumptions.

COLLEGE SCIENCE INSTRUMENTATION

Huseyin R. Hiziroglu USE 8851806
Bhag S. Guru FY88 $100,000
GMI Engineering and Mgmt Institute Electrical Eng
Flint, MI

"A High-Voltage Laboratory"

This project exposes students to a laboratory environment that supports their studies in high voltage generation and measurement techniques. In addition to validating theoretical concepts, the high voltage laboratory allows students to design, construct and test different types of high voltage generators. It permits hands-on experiences where students observe reactions of particular insulators to high voltages, and it provides an environment where students gain a practical intuitive understanding of some highly theoretical topics.

This award is being matched by a greater then equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Charles V. White USE 8750457
GMI Engineering & Mgmt Institute FY87 $22,100
Flint, MI Mechanical Eng

"An Undergraduate Quantitative Materials Measurement and Assessment Laboratory for the Manufacturing and Systems Engineering Program"

A course, part of the new Manufacturing and Systems Engineering program, is being developed. This laboratory based course, Quantitative Materials Measurement and Assessment, will use the student's materials manufacturing and statistics background to investigate state of the art materials measurement techniques and their applications in manufacturing process control. Students will test their knowledge of fundamental material phenomena through projects, utilizing computer aided measurement and analysis equipment to assess manufacturing process parameters. The equipment requested in this proposal is a state of the art high resolution, computer driven image analysis system, a dead weight loading micro hardness tester and precision diamond saw. Using this equipment, the students will learn that the control of in-process and final product quality begins with detailed knowledge of the material.

COLLEGE SCIENCE INSTRUMENTATION

Maciej Zgorzelski USE 8852179
GMI Engineering and Mgmt Institute FY88 $100,000
Flint, MI Mechanical Eng

"Computer Integrated Manufacturing Laboratory"

This project supports a new undergraduate program in Manufacturing Systems Engineering at this institution and the capstone course, Computer Integrated Manufacturing (CIM). The new laboratory consists of several pieces of flexible manufacturing equipment (numerically controlled machine tools, robots, automated guided vehicles) and integrated computing equipment. The CIM laboratory is networked to an existing Computer Aided Design System so that students experience a complete production cycle (from product design, to manufacturing, to assembly) in a "factory of the future" computerized environment.

This award is being matched by an equal sum from the grantee.

PRIVATE SECTOR PARTNERSHIPS

P.Douglas Kindschi
Mary A. Sheline
David Tanis
Grand Valley State College
Allendale, MI

TPE 8751919
FY88 $166,011
FY90 $215,150
Other NEC

"RET-EEE- Recognize Exemplary Teachers - Expand, Enlist and Extend"

This program will strengthen middle and high school science and mathematics teaching by joint efforts of exemplary teachers and college and industry scientists, engineers, and mathematicians. Twenty exemplary teachers will be selected for recognition and involvement in an ongoing program of materials development and teacher enhancement. The knowledge of ten of these teachers will be expanded through a summer work program in local industries. Industry and university scientists/engineers will be enlisted to form triads with the teachers to design and develop classroom materials and activities based on the industrial experience. Use of these materials in college teacher preparation courses and for inservice training of other local practicing teachers will extend the impact of the program. The ultimate objective will be to better prepare students for the world of work, whether they chose to enter that world immediately or wait until completion of some further post-secondary education.

Cost sharing by the partners will total 67% of the NSF funding.

TEACHER ENHANCEMENT PROGRAM

Eugene C. Jekel
Hope College
Holland, MI

TPE 8742405
FY85 $118,244
FY86 $132,342
FY87 $141,838
Chemistry

"Summer Honors Workshop for Teachers of High School Chemistry"

The Summer Honors Workshop at Hope College for Teachers of Advanced Placement and Second Year High School Chemistry honors and strengthens the subject matter background of 40 lead teachers selected by their school districts. Outstanding lecturers will present five key topics: Chemical Equilibrium, Thermodynamics, Oxidation-Reduction and Electrochemical Cells, Kinetics, and Bonding and the Geometry of Molecules. Laboratory work will be emphasized throughout the project with pertinent experiments integrated with the lecture topics. Sessions will be held before and after each laboratory. The participants will assemble a collection of resource materials and laboratory experiments for use in their classrooms and to share with their peers.

This project will develop initiatives for effectively forming cadres of master teachers, updating the sciences of these teachers and providing teachers who can assist directly in local precollege education.

TEACHER ENHANCEMENT PROGRAM

Eugene C. Jekel
Hope College
Holland, MI

TPE 8751702
FY88 $149,836
Chemistry

"Summer Workshop and Leadership Activities Project for Teachers of High School Chemistry"

This is a 12-month program that will equip 40 Advanced Placement chemistry teachers to be more effective in the presentation of Advanced Placement chemistry courses, and to provide in-service assistance to their colleagues. The project includes intensive training for five weeks on five key topics: chemical equilibrium, chemical thermodynamics, oxidation-reduction reactions and electrochemical cells, chemical kinetics, and bonding and geometry of molecules. There is a strong emphasis on laboratory experiments designed to teach these fundamental topics effectively.

COLLEGE SCIENCE INSTRUMENTATION

Ned C. Rouze
Hope College
Holland, MI

USE 8852136
FY88 $8,535
Physics

"Verification of the Uncertainty Principle in the Hope College Advanced Laboratory Course"

This project will add an experiment to the Advanced Physics Laboratory course to verify the time-energy uncertainty relation (Delta) and lifetime of an excited level of (57)Fe. The uncertainty in energy of the level will be measured using the Mossbauer effect which allows the natural linewidth of the emitted gamma rays to be determined using the Doppler effect and resonant absorbtion. The uncertainty in lifetime will be determined by measuring the time between the production and decay of the same nuclear level using fast electronic components.

The equipment needed for this investigation will also be used for general improvements to the Advanced Laboratory course. In particular, the nuclear Zeeman effect will be studied using the Mossbauer apparatus with a ferromagnetic absorber in which the nuclear levels are split by an internal magnetic field produced by the electronic motion.

The grantee will match the NSF funds with an equal amount of non-Federal funds for this project.

INFORMAL SCIENCE EDUCATION

Robert L. Russell	MDR 8550266
Impression 5 Museum	FY85 $301,500
Lansing, MI	FY86 $414,600
	FY87 $423,900
	FY88 $ 7,892
	Museums

"Exhibit Research Collaborative"

A group of eight science centers from across the country have formed a collaborative to pool their expertise in developing and replicating science exhibits to circulate to member institutions. The exhibits will cover a diversity of areas such as perception, energy, space spin-offs and an aerospace exhibit aimed at minority youngsters. A prototype of each exhibit will be developed and tested at the museum site. After formative evaluation and floor testing, a copy will be made to travel to other member museums. The exhibits will be seen by approximately 40 million people. NSF funding represents 60 percent of the total cost.

Member museums include: The Museum of Science, Boston, Massachusetts; The Louisville Museum of History and Science, Kentucky; The Reuben Fleet Space Theater and Science Center, San Diego, California; Impression 5 Science Museum, Lansing, Michigan; The Science Museum of Virginia, Richmond; The Pacific Science Center, Seattle, Washington; The Oregon Museum of Science and Industry, Portland; The Science Museums of Charlotte, North Carolina.

The FY88 supplement will allow members' museums staff to meet together to plan for exhibition installation and circulation and exchange of educational materials for the eight circulating exhibitions.

PRIVATE SECTOR PARTNERSHIPS

Robert L. Russell	TPE 8851059
Impression 5 Museum	FY88 $ 84,960
Lansing, MI	FY89 $182,575
	Informal Science

"Community-Based Science Programs for Minorities"

In partnership with industrial firms, The Impression 5 Science Museum will organize and operate a program to encourage disadvantaged minority children and their families to develop an interest in and knowledge of science. This will involve a variety of activities -- science clubs, field trips, exhibitions -- designed to reach children and parents in settings familiar to them. Mini-museums will be set up in appropriate community centers. A bus modified to look like a space shuttle will be used to bring science activities to fairs, neighborhood settings, and other locations, and to transport children to other points of interest, including the main museum. The program will be carried out in close cooperation with the schools, but outside of school hours. Because the Lansing schools already bring all fourth graders to the museum, inservice programs for those teachers will be arranged by the museum utilizing industry and university scientists. The support od industry will be both financial and through its people -- as participants in planning and presenting science activities for children and teachers and as role models. Cost sharing by industry and the museum will equal 63% of the NSF funding.

PRIVATE SECTOR PARTNERSHIPS

Jon R. Thompson	TPE 8751501
Kalamazoo Area Mathematics & Science Center	FY88 $147,358
	FY90 $168,653
Kalamazoo, MI	HS Sci/Math

"Kalamazoo Community-Based Partnership Project - People to People"

The Kalamazoo Area Mathematics and Science Center, established in 1985 with a $2,000,000 gift from the Upjohn Company, provides facilities for advanced mathematics and science activities and courses for high school teachers and students from nine public and three non-public school districts. This project will develop and implement expanded programs for utilizing technical professionals from area industries, hospitals, and other non-educational organizations as well as from neighboring higher educational institutions to expand the programs of the Center, both internally and through outreach to area schools. These outside professionals will be utilized in two capacities. As resources persons, they will work with teachers in enriching class curricula through consulting, classroom presentations, and assisting in the development of teaching materials. As mentors, they will help individual students devise and conduct research projects. Replicable procedures for recruiting, training, and utilizing such resource persons and mentors will be developed and disseminated widely for use in other communities.

Cost sharing by the partners will total 100% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Lyn H. Raible	USE 8750179
Kalamazoo College	FY87 $13,474
Kalamazoo, MI	Psychology

"Physiological Psychology Expansion Project"

The objective of the project is to develop the physiological psychology program at Kalamazoo College to a level that allows students to: (1) have access to a laboratory course in physiological psychology, (2) participate in group research projects, and (3) conduct supervised, but independent research projects. At present, insufficient equipment for animal care and the lack of some basic laboratory equipment have precluded the expansion of the physiological psychology program. The acquisition of cage washing equipment and animal housing will allow the expansion of the animal care facility, thereby increasing the research capacity. The acquisition of equipment necessary for brain surgery (drills, stereotaxis, cryostat, microscope) will greatly expand the surgical techniques that can be used in research and, when combined with the equipment already possessed by the College, will provide students with enormous flexibility in the type of research they can conduct. Increased research capacity and complexity will significantly improve the department's ability to train students in the techniques and theories of physiological psychology and related fields.

COLLEGE SCIENCE INSTRUMENTATION

Paul R. Sotherland USE 8750850
Kalamazoo College FY87 $9,846
Kalamazoo, MI Biology

"Computerized Data Acquisition in Undergraduate Animal Physiology Laboratories"

Computerized Data Acquisition is being developed as a part of the laboratory for an upper-level course in Animal Physiology. The course consists of a lecture series based on the textbook Animal Physiology: Mechanisms and Adaptations by R. Eckert and D. Randall, and a laboratory. A series of experiments give students an opportunity to collect physiological data using a computerized system. Students use transducers interfaced with an IBM-XT microcomputer to monitor processes in an experiment through the Lab Linc system. Using the data handling software, Videograph, the students simultaneously store the data on a floppy disk.

Undergraduates completing these experiments have a better understanding of concepts and of state-of-the-art methods in Animal Physiology, and thus are better prepared to do further work in this area. In addition to its utilization in course work, the equipment is being used extensively by both Health Science and Biology majors, all of whom are required to complete independent study projects.

COLLEGE SCIENCE INSTRUMENTATION

Jan Tobochnik USE 8851210
Kalamazoo College FY88 $13,750
Kalamazoo, MI Physics

"Computer Simulation Laboratory for Undergraduate Thermal Physics and Introductory Physics"

The grantee will purchase five high-speed scientific workstations. These will be used to improve instruction in the upper-division Thermal Physics course, and in the Introductory Physics sequence. Molecular dynamics and monte carlo simulation techniques will be introduced in the Thermal Physics course. In the introductory courses the workstations will be used to simulate simple, but nonlinear, mechanical systems, and for electrostatics simulations.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Robert D. Chute USE 8750563
Lawrence Institute of Technology FY87 $22,494
Southfield, MI Electrical Eng

"An Undergraduate Electricaltrical Machines Laboratory"

This project will improve the quality of instruction in electromechanical device application, control and design. Seven Hampden machine stations will be added to the laboratory which presently supports three machine oriented courses. Included will be AC and DC variable powers sources, dynamometers, instrumentation and three phase and single phase machines which represent the basic machine types in general use today. This laboratory will form the basis of future control systems and special motor experiments.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Glenn D. Berkheimer MDR 8550336
Harry A. Eick FY86 $161,239
Charles W. Anderson FY87 $168,131
Michigan State University Other NEC
East Lansing, MI

"Educational Systems to Increase Student Achievement"

The purpose of this project is to design an approach to science instruction that takes into account some findings from cognitive research. It has been widely demonstrated that students come into the classroom with invalid perceptions about physical phenomena which are not altered by current forms of instruction. Through interviews, this project will document the general misconceptions held by students, identify these for teachers, and develop methods which directly confront the misconceptions. The student materials will consist of a unit, "Models of Matter", which will be modified to also confront the commonly held misconceptions. The final product will be an educational system that integrates learning activities and teaching strategies to cause conceptual change.

The modified "Models of Matter" unit will be randomly assigned to 12 of 24 Lansing, Michigan Public School grade six classes to test its effectiveness in increasing student achievement and promoting recommended teaching strategies. The remaining 12 sixth grade classes will use the unmodified "Models of Matter" unit.

The project expects to demonstrate how authors can use existing research findings to modify commercial textbook units and teacher guides to increase student learning. Since most teachers structure their teaching around a commercial textbook, the project has national significance for improving student achievement in science.

FACULTY ENHANCEMENT

P.David Fisher
Michael A. Shanblatt
Gregory M. Wierzba
Timothy A. Grotjohn
Anthony L. Rigas
Michigan State University
East Lansing, MI

USE 8854147
FY88 $62,506
Electrical Eng

"Advanced Design Methodologies for Large-Scale Electronic Circuits"

The fundamental approach to designing, testing, and manufacturing electronic circuits has changed dramatically in the past decade. This undergraduate faculty enhancement project is intended to update university science and engineering faculty on the critical advances that have taken place recently in the area of electronic circuit design with the intent that participants will take this material back and immediately build it into their curricula. Phase one of this project will be held at Michigan State University (M.S.U.), where participants will receive intensive classroom briefings and gain laboratory experience with circuit design and circuit test equipment in the newly completed Electronic Research and Development Laboratory (ERDL). During phase two, participants will complete designs and prepare a report back at their own schools. During phase three, M.S.U. will serve as a center of expertise and assist the participants as they incorporate this new material into their curricula. Included will be at least one site visit to each participating university/college and a one-day workshop at M.S.U. Participants will be encouraged to keep in touch with each other and with the faculty at M.S.U. via electronic mail and other appropriate means to ensure that experiences gained can be shared. Seeking advice and sharing information will be encouraged even after the formal project has ended.

In addition to the NSF funds, participants' institutions will contribute about 10% in travel funds toward the cost of the project.

TEACHER ENHANCEMENT PROGRAM

William M. Fitzgerald
Glenda Lappan
Michigan State University
East Lansing, MI

TPE 8651685
FY87 $224,917
Mathematics

"Honors Workshop for Middle Grade Mathematics Teachers"

This project offers twenty-five selected teachers of mathematics in grades 6, 7, and 8 the opportunity to participate in a four-week Honors Workshop at Michigan State University during the summer of 1987. This will enable these teachers from the midwest to earn 6 hours of credit in Mathematics Education.

The participants will be provided with a special intensive program designed to update their knowledge of mathematics and its uses. They will also study ways to improve their instruction of mathematics at the middle grade level. An interesting "multiplier" effect of the program is the attendance of two proteges of each participant during the fourth week of the program. These additional teachers will also be active participants in the workshop. All participants will be provided with materials and plans with which to return to their communities as leaders in mathematics education. Materials used will be principally those developed through the Middle Grade Mathematics Project, an NSF-funded curriculum development project. Excellent support has been generated from local school districts to ensure implementation at the school level.

During the second summer, the participants, with considerable local support, will conduct workshops for their peers under the guidance of the project staff. Throughout the project the focus will be on building a local network of teachers to continue the project activities in addition to exchanging ideas and providing broader support.

Dr. Fitzgerald has extensive experience in mathematics and mathematics education, having worked at the secondary as well as at the university level. He has organized and conducted many conferences on various topics in mathematics and served in the capacity of staff member and director for several NSF-funded programs. Dr. Lappan, Co PI, has an equally impressive background, but, in particular, was Project Director for the NSF-funded Middle Grades Mathematics Program. These materials are an integral part of this proposal.

TEACHER ENHANCEMENT PROGRAM

Penelope Peterson
Andrew Porter
Michigan State University
East Lansing, MI

TPE 8850909
FY88 $16,841
Other-NEC

"Institute for Research on Teaching/American Federation of Teachers/Toledo "Support Teacher" Project"

This award will support a five-day workshop involving eight teachers who have been selected and prepared to serve as "support teachers" in the Toledo public schools. The eight teachers are divided into four two-person teams. Each team consist of one science teacher and one mathematics teacher; four different schools are served, each by one team. A support teacher is assigned a reduced classroom load and therefore has time to work with other teachers who are less well prepared. The workshop is a small but essential part of a larger venture that was designed and conducted by the Institute for Research on Teaching (IRT) at Michigan State University in collaboration with the American Federation of Teachers and the Toledo Public Schools. During an already-completed phase of the project, the eight teachers participated in 30 hours of professional development seminars conducted by IRT personnel. This workshop, scheduled for August of 1988, will serve to solidify gains the teacher have made in knowledge and skills. In the fall they will assume their new duties as support teachers in the Toledo schools.

This project will test a model for the preparation of support teachers and will assess whether the use of support teachers is an efficient mechanism for achieving improvements in the teaching of science and mathematics in the schools.

YOUNG SCHOLARS

Gail Richmond
Charles R. Peebles
Michigan State University
East Lansing, MI

RCD 8755794
FY88 $80,961
Life Sciences

"Summer High School Honors Science Program"

A High School Honors Science Program has been held on the campus for the past 29 summers. It consists of a 48- day program directed toward high school juniors and sophomores. It allows individuals to select a topic of interest within experimental biology, biophysics, or plant science and to conduct independent research under the supervision of a volunteer faculty advisor in whose laboratory they work. In addition to lab work, students are taught how to use library facilities, are required to keep a daily log of their activities and prepare final oral and written reports. The students are housed in a university residence hall under the supervision of experienced counselors.

FACULTY ENHANCEMENT

Ann L. Maclean
David D. Reed
Margaret R. Gale
Michigan Technological Univ
Houghton, MI

USE 8854155
FY88 $68,986
Environmental

"Geographic Information Systems Workshop for Undergraduate Faculty Enhancement"

Michigan Technological University will operate a series of workshops in the area of geographic information systems (GIS). The workshops are critical to fill a need in keeping undergraduate faculty members abreast of new ideas and techniques utilizing geographic information systems. This will result in the updating of GIS courses. Hence undergraduates will have the appropriate knowledge and training for employment as a GIS specialist.

Two two-week workshops will be held at the School of Forestry and Wood Products, Michigan Technological University, Houghton, Michigan. The workshops will provide the participants with an opportunity to meet, receive state-of-the-art information, gain hands-on experience, exchange ideas, and develop appropriate lectures and laboratory exercises for undergraduate GIS courses. In addition, attendees will meet with several GIS managers to see how a GIS operates on a day-to-day basis, and determine what employees deem important for undergraduate GIS students to know.

Success of the project will be determined by a questionnaire assessing both the quality of the workshop and the utility of the lecture and lab manual developed as part of the workshop.

In addition to the NSF funds, participants institutions will provide about 15% in travel costs toward the operation of the project.

YOUNG SCHOLARS

John O. Kiltinen
Marilyn M. Robbert
Northern Michigan University
Marquette, MI

RCD 8850293
FY88 $34,729
FY89 $34,729
Mathematics

"Seaborg Summer Science Academy"

The Seaborg Summer Science Academy is an intensive, two-week residential program of instruction in science and mathematics for forty high school students entering the 11th or 12th grades.

The Academy participants take a core course, Problem Solving in Mathematics and Science. In this course, they develop and refine skills in handling challenging problems while working together in teams. Students also select two science elective courses and two in mathematics.

This is the sixth summer that the problem solving course has been offered.

FACULTY ENHANCEMENT

Joseph D. Hovanesian	USE 8854178
Yau Y. Hung	FY88 $101,023
Howard R. Witt	Mechanical Eng
Oakland University	
Rochester, MI	

"Short Course in Applied Optics for College Teachers"

Twenty-five undergraduate teaching faculty attending this two-week short course will work with the principles and applications of optics in engineering. A mixture of lectures, demonstrations, with hands-on laboratory experiments and projects represents the core of this enhancement program. Participants will be provided with a prepared set of notes on most topics which will be covered including Fourier analysis, diffraction theory, interferometry, geometrical optics, holography, shearography, Moire' methods, optical data processing methods, nondestructive testing, and digital image processing. Participants will have intensive work experience with the latest in optical equipment and related instrumentation, much of which is computer controlled. Oakland University possesses outstanding applied optics facilities, which will enable participants to work with the modern instrumentation. In addition, the very latest equipment available will be borrowed from manufacturers and suppliers and set-up in Oakland's laboratories for participant use.

A follow-up evaluation of the impact of this enhancement experience will be conducted one year later.

In addition to NSF funds, participants' institutions will provide about 10% in travel costs toward the operation of the project.

COLLEGE SCIENCE INSTRUMENTATION

Peter J. Moehs	USE 8750521
Saginaw Valley State College	FY87 $34,500
University Center, MI	Chemistry

"Improving Undergraduate Laboratory Instruction in Chemistry Through the Use of Energy Dispersive X-Ray Fluorescence Spectroscopy"

The recent acquisition of an energy dispersive x-ray fluorescence (EDXRF) spectrometer allows this instrument to be used in the analytical/physical course sequence in chemistry at Saginaw Valley State College. Students have an opportunity to demonstrate the character of atoms through generation of line spectra, to show the relationship between x-ray photon/electron interactions using Compton shift and other effects relating to absorption edges, absorption and photoelectric effects. Since EDXRF is a rapid, non-destructive technique, students who carry out experiments utilizing this instrument acquire up-to-date qualitative and quantitative analytical techniques and a basic understanding of atomic structure and the properties of x-rays, required to enter their respective scientific fields.

RESEARCH IN TEACHING AND LEARNING

Phyllis Blumenfeld	MDR 8550437
Judith L. Meese	FY85 $109,622
University of Michigan	FY86 $ 35,339
Ann Arbor, MI	FY87 $ 29,628
	Elem Science

"Mastery Orientation Toward Learning Science in Elementary Schools"

This study will examine the effects of tasks, teacher behavior and individual characteristics on students' motivation to master cognitively complex science material. The Principal Investigators plan to:

- select 10 well-managed 4th and 5th grade classrooms taught by experienced science teachers,

- identify children with different orientation toward achievement,

- select three science units which require critical thinking, but where the tasks vary in their format and social organization,

- observe and detail teacher and student behavior during these units,

- survey and interview children following observations to explore their perceptions of task demands, expectations for performance, learning strategies, and understanding of lesson.

The data from student interviews, teacher questionnaires, and classroom observations will be used to characterize the learning orientation of students. The research design will allow a comparison of the reactions of individual students, both within a classroom and to similar tasks across classrooms. In this manner, the investigators plan to identify the individual and situational factors that promote development of a mastery orientation toward science learning.

The results will be disseminated through packaged materials, workshops and conference presentations given at local, regional and national levels.

COURSE AND CURRICULUM

H.Scott Fogler
University of Michigan
Ann Arbor, MI

USE 8854538
FY88 $244,900
Engineering

"Development of Innovative Engineering Students"

The objective for this project is to provide educational experiences for chemical engineering students that will enhance the development of innovative and creative skills. Interactive computer modules and open- ended problems are being developed for use with each of the core (required) courses in the chemical engineering program. The modules and open-ended problems will complement the normal engineering course examples and homework problems and are expected to provide frequent opportunities for the students to practice the divergent thinking skills needed for the practice of engineering and yet leave enough time for learning the necessary engineering fundamentals. It is expected that the added motivation for learning fundamentals provided by the modules and the open-ended problems will be such that the engineering fundamentals are covered as fully as before.

The institution has committed matching funds that are approximately one- third of the funds requested from NSF for this project.

This project is co-funded with the NSF Directorate for Engineering.

TEACHER ENHANCEMENT PROGRAM

David M. Gates
Burton E. Voss
University of Michigan
Ann Arbor, MI

TPE 8550141
FY85 $132,049
FY86 $119,625
FY87 $122,375
Biology

"Honors Workshop for Secondary School Biology Teachers"

This project will provide enhancement experience for selected high school biology teachers through an intensive two-month workshop at the University of Michigan Biological Station, a 10,000-acre lakeshore research and teaching facility located on the northern tip of the state's lower peninsula. Twenty five teachers in each year will improve their knowledge of field biology and their pedagogical skills through completion of four interrelated activities.

Through participation in a biological curriculum development workshop, teachers will experience firsthand the study of a variety of biology topics treated through readings, lectures, and field exercises. After completing their studies, they will evaluate and discuss the design and adaptation of the materials and methods for their own classroom. As they develop new insights related to such field-centered learning and teaching, they will design an individual field exercise treatment of a topic of their choice. These materials, along with the resources provided by the instructors, will be compiled and given to the teachers to use in their own classrooms during the following academic year.

Second, each teacher will enroll in one advanced biology course of their choice. Third, a series of special lectures and seminars will be offered featuring distinguished visitors to the Biological Station. Lastly, during the following school year, the participants will tryout the new materials and teaching methods. They will conduct inservice sessions with other teachers in their schools. All participant will return to the Biological Station in February for a weekend winter workshop to share discussions of their classroom trials and their inservice sessions, to provide feedback prior to publication of the project materials, and to participate in a short workshop on winter ecology.

The purposes of the Honors Workshop program include the formation of leadership groups of able teachers around the country, the enhancement of the scientific and pedagogical knowledge of these teachers, and the provision of quality resource persons to assist directly in the improvement of precollege science, mathematics and technology education. This project will further the aims of the program.

The project director and academic staff of the Biological Station are highly qualified to conduct this project. They have conceptualized an innovative, substantial approach which ensures a successful activity.

APPLICATIONS OF ADVANCED TECHNOLOGY

James A. Kulik
University of Michigan
Ann Arbor, MI

MDR 8470258
FY85 $144,050
FY86 $240,997
FY87 $ 20,279
Other NEC

"Critical Synthesis of Factors in Science Teaching and Learning Using Instructional Technology"

This supplemental work will produce a monograph-length document describing in both narrative and quantitative terms the conclusions that can be drawn from approximately 100 quantitative syntheses covering 4,350 studies relevant to science education. The monograph will cover six major areas: teaching methods and their influence on learning; factors that influence effectiveness of teaching materials; organization of classrooms for effective instruction; student characteristics that influence science learning; teacher characteristics and their influence; and curriculum revision and science learning. The report will be widely disseminated and should be valuable for developing science education policy and for planning research and development efforts.

FACULTY ENHANCEMENT PROGRAM

William M. Spurgeon
Elsayed A. Orady
John Cherng
Edward Lumsdaine
James W. Knight
University of Michigan
Ann Arbor, MI

USE 8854197
FY88 $136,318
Engineering

"Faculty Enhancement for Undergraduate Programs in Manufacturing Engineering"

The program will enhance the knowledge and instructional skills of forty-eight faculty members in the field of manufacturing engineering. These members will come from colleges and universities primarily in the midwest. Institutions are striving to establish undergraduate programs in manufacturing engineering but are severely handicapped by the shortage of qualified instructors. The shortage can be alleviated by upgrading existing faculty.

The program comprises four sessions, with intervals of days to weeks to allow for preparatory work. Topic outlines for the sessions are as follows:

Session I: Clinic and Instruction in Manufacturing Engineering. Program overview. Identification and analysis of instructional problems. Frameworks for organizing instruction in manufacturing engineering. Manufacturing operations. Kinds of manufacturing engineers. Five intensive short courses in the areas of time management, creativity and innovation, and personal networking.

Session II: Productivity- Related Projects. Simultaneous engineering. Part design for performance and producibility. Part fabrication. Applications of computers. Preparation of a process specification manual. Cost reductions. Research frontiers for the process selected. Human factors. Three laboratory/plant tours.

Session III: Product Quality-Related Factors. Ascertaining what customers want. Design of products for quality. Quantitative Ishakawa diagrams. Taguchi methods. Preparation of a product quality manual. Modern nondestructive test methods. Pilot run. Two plant tours.

Session IV: Design and Fabrication of Instructional Aids. Workplace engineering. Replacement theory. Pros and cons of computers in manufacturing. Manufacturing management. Visit to the headquarters of the Society of Manufacturing Engineers. Provision will be made for networking the participants by computer and by follow-on seminars held annually for three years.

In addition to the NSF funds, participants' institutions will contribute about 5% in travel costs to the operation of the project.

RESEARCH IN TEACHING AND LEARNING

Harold W. Stevenson
University of Michigan
Ann Arbor, MI

MDR 8751390
FY87 $190,079
FY88 $197,528
Studies

"Mathematics Achievement: Japanese, Chinese, and American Children"

Six research studies conducted in the past six years have investigated the mathematics achievements of Chinese, Japanese, and American children. Children have been given achievement tests in mathematics, reading, and a variety of cognitive tasks. They have been interviewed about their motivation concerning mathematics. Mothers and teachers have been interviewed about their beliefs and practices. Observations have been conducted in the children's classrooms. Children chosen for the studies include representative samples from kindergarten, grade 1 and grade 5 in large urban areas, including Minneapolis, Chicago, Beijing, Sendai, and Taipei. The purpose of the project is to complete the analyses of the data collected in these studies and to write the results so that they will be available to scientific, professional, and lay audiences. The goal is to provide information that will be useful in improving mathematics education of American children, both at school and at home.

This project is unique in providing knowledge relating complex social and cultural factors to early development of mathematics abilities in young children. It promises to yield a large data set, rich--even if complex--in its implications for understanding the relationship between the value placed upon mathematics in American society today (as reflected in its schools) and the future strength of the U.S. science and technology enterprise.

TEACHER ENHANCEMENT PROGRAM

Mary J. Whitmore
University of Michigan
Ann Arbor, MI

TPE 8751767
FY88 $121,431
FY89 $125,871
FY90 $126,388
Other NEC

"Regional Educators Network and Enhancement Workshop (RENEW)"

This project, Regional Educators Network and Enhancement Workshop (RENEW) builds on the strengths of an honors workshop, A Special Summer Institute for Science Teachers (ASSIST) funded by NSF. Twenty-five teachers per year, from high school, middle school and elementary schools respectively, will participate in an eight-week summer Enhancement Workshop at the University of Michigan Biological Station. This Workshop will emphasize techniques in science education, peer coaching, mentor-teaching, and other effective strategies to enhance their science teaching. In addition, each teacher will choose one of the regularly offered courses at the Biological Station to update and enhance their biology content background.

Project ASSIST participants will work with these teachers in their schools during the school year. In years two and three of this project, a network of participants and previous participants will work in each of five local regions in the state of Michigan to implement improved science teaching, to communicate with each other, and to disseminate information to colleagues in their regions. State funds have been utilized in initiating a pilot version of this network.

Thirty-two percent of the budget for this project is cost-shared by contributions from the University and school districts. The cost of released time, substitutes, and materials to implement the program is borne by the schools. State of Michigan funds are being used to support the "veteran" teachers in their support of participants.

COLLEGE SCIENCE INSTRUMENTATION

Kiumi Akingbehin
James W. Knight
University of Michigan Dearborn
Dearborn, MI

USE 8750293
FY87 $44,586
Electrical Eng

"An Undergraduate Laboratory for Real Time Computing and Control."

A real time computing laboratory will be set up under this project. It will provide the facilities to support a three hour course for undergraduate engineering students in the fundamentals of real time computing and control. The laboratory will consist of a DEC Microvax II used as a software development station tied by Ethernet to another DEC Microvax II running Labstar real time software and acting as a controller of various equipment. Among the items to be controlled include a robot and computer numerically controlled machines. The system will include the capabilities to support up to twenty users developing software and then running their software individually through the controller.

COLLEGE SCIENCE INSTRUMENTATION

Keshav S. Varde
University of Michigan Dearborn
Dearborn, MI

USE 8750321
FY87 $40,012
Mechanical Eng

"Undergraduate Mechanical Engineering Laboratory Improvement"

This project will upgrade the existing undergraduate mechanical engineering laboratories. Modern computer-controlled flow measurement, dynamometer, and pressure and temperature sensors will be integrated into new experiments. The experiments will cover the performance of heat pumps, internal combustion engines and metallurgical and structural components. Automation of a solar collector to determine absorption, heat losses, and collector efficiency is planned.

TEACHER ENHANCEMENT PROGRAM

Joella Gipson
Wayne State University
Detroit, MI

TPE 8751445
FY88 $139,797
FY89 $209,719
FY90 $192,624
Mathematics

"Institute for Enhancement of Mathematics Teachers"

The proposal is for a three-year institute that will help a cadre of 50 mathematics teachers in grades 7-10 learn modern mathematics concepts, develop programming skills, and learn effective leadership and teaching methods. These lead teachers are to work with other teachers, thereby affecting approximately 240 teachers, throughout the duration of the project. A problem solving approach is to be taken that emphasizes algebra and geometry integrated with computing. The recruitment and selection process is designed to emphasize selection of teachers in underrepresented groups. During the first summer, activities will consist of courses in mathematics, mathematical problem solving, and discussions on instructional strategies. During the academic year, cadre members will attend additional courses and work in the laboratory of the center. In their teaching they will pilot test the teaching modules that they develop in the workshop under the supervision of the project staff. Classes and demonstration lessons are to be video taped during the school year and used by the cadre members with other teachers. During the second summer, the cycle will begin anew with an additional 25 cadre members, and the workshop will involve members of the earlier cadre group. The initial cadre will also take additional courses during the second summer and prepare to establish instructional settings for other teachers. The third year of the project is to involve all cadre members in working with other teachers, who will, in turn, be observed and video taped by the project staff.

MINNESOTA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Edwin D. Andersen
Mathematics
Southwest High School
Minneapolis, MN

Steven D. Ethen
Science
Burnsville High School
Burnsville, MN

1988

Eleanor Matsis
Mathematics
North Community High School
Minneapolis, MN

David C. Arlander
Science
John Adams Junior High School
Rochester, MN

COLLEGE SCIENCE INSTRUMENTATION

Brian J. Anderson	USE 8852403
Augsburg College	FY88 $17,146
Minneapolis, MN	Physics

"A High Vacuum Laboratory for Undergraduate Instruction"

High vacuum technology underlies much of current experimental science and "high technology," and provides an excellent basis for training advanced undergraduates. The Physics Department will complete the development of a high vacuum laboratory featuring four multipurpose vacuum stands (medium high vacuum, gas analysis with mass spectrometry, gas mixing, and ultra high vacuum), and continue ongoing curriculum developments related to this laboratory. Experiments will include topics in atomic and molecular properties using mass spectroscopy, plasma physics, gas-surface interactions, and vacuum technology. The equipment to be purchased includes a modern quadripole mass spectrometer, PC-based computer controllers and computer-compatible sensors, and selected vacuum items needed to complete stand fabrication. The vacuum laboratory will be used by both Physics and Chemistry students in several upper division courses, and by technical employees in local industry enrolled as part of an ongoing educational partnership.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

John E. Senior	TPE 8751220
Naum Kipnis	FY87 $28,350
Bakken Library of Electricity in Life	Physics
Minneapolis, MN	

"Experimental Foundations of Waves and Vibrations: A Summer Institute for High School Physics Teachers"

This project provides funds for a three-week summer workshop for 20 teachers of physics and physical science, grades 7-12, during the month of July, 1987. The workshop entitled "Experimental Foundations of Waves and Vibrations" will enable the participating teachers, through the reenactment of historical experiments in the areas of optics and acoustics, to study and understand the role of experimentation in creating scientific knowledge. The teachers will have the opportunity to build and assemble the equipment essential for several of the historically critical experiments in the field. They will be urged to take ideas and resources back to their middle and high school classrooms to enrich their instruction of precollege students and to provide inservice education for their peers.

The workshop will be held at the Bakken: Museum and Library of Electricity in Life. The unique facilities of this institution will be available to the participants. The staff for the workshop will be drawn from the Bakken and university scientists. University of Minnesota credit will be given to the participants who successfully complete the workshop.

This project utilizes an innovative and creative approach to the enhancement of teacher knowledge in the physical sciences. The teachers will enrich their understanding of the historical development of an area of science as well as increase their conceptual understanding of the area. The project is a collaborative effort among a museum, university, private sector businesses and school districts. A resource book of physics experiments will be distributed to physics teachers throughout the state of Minnesota.

COLLEGE SCIENCE INSTRUMENTATION

Kirk P. Manfredi	USE 8851455
Bemidji State University	FY88 $30,850
Bemidji, MN	Chemistry

"Improvement to the Undergraduate Laboratory Curriculum "

The Department of Chemistry is improving and modernizing the undergraduate laboratory curriculum. Specifically, the Department is introducing NMR spectroscopy into the "Project Lab" chemistry courses. "Project Lab" is a unique approach to laboratory instruction which emphasizes individual achievement and preparedness in the chemistry laboratory. With the many applications of NMR spectroscopy the Department is implementing NMR experiments in all areas of chemistry. Experiments are being introduced into the undergraduate lab which are unique to the NMR phenomenon. Ultimately the Department would like to publish some of these experiments to assist other undergraduate institutions in fully utilizing their NMR instructional facilities. The specific piece of equipment that is being utilized is a 60 MHz spectrometer equipped with a variable temperature probe.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Robert C. Pickett
Bemidji State University
Bemidji, MN

USE 8750197
FY87 $16,310
Electrical Eng

"Computer Assisted Engineering in an Undergraduate Engineering Physics Program"

Two workstations will be added to the Engineering Physics program resulting in a three quarter sequence in computer aided engineering. The IBM PC/AT will be used to introduce the student to the ASSYST data acquisition and processing software, MICROCADAM mechanical design functions, and EE DESIGNER circuit simulation and design. A Motorola VME Module system will be used as a UNIX workstation to introduce finite element analysis via the CASA/GIFTS software. The result will be that the students are introduced to the workstation concept of engineering early in their course of instruction so that future courses can build on it.

COLLEGE SCIENCE INSTRUMENTATION

Jerry A. Eberhart
Carleton College
Northfield, MN

USE 8851171
FY88 $63,936
Psychology

"Neuroscience Laboratory (Psychology)"

In response to the growing importance of neuroscience research in the behavioral sciences, a neuroscience laboratory has been established for teaching in Psychology. Laboratory experience at all levels of the undergraduate social science curriculum is offered from freshman seminars to advanced seminars and independent research projects. The core of this project is a new upper level course, Laboratory in Physiological Psychology, which provides instruction in modern neuroanatomical methods. This project requires equipment for preparation of animals, for histological processing of neural tissue, and for analyzing and recording the resulting material. Thus, the equipment includes operating microscopes for surgery, a sliding microtome to cut frozen sections, and compound microscopes equipped to observe and record fluorescent tracers. This facility complements the college's molecular neuroscience facility in Biology and makes available comprehensive neuroscience laboratory courses.

The award will be matched by an equal amount from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Jack Goldfeather
Carleton College
Northfield, MN

USE 8750099
FY87 $39,430
Mathematics

"An Undergraduate Computer Graphics Laboratory for Mathematics and Computer Science"

Under this project, Carleton College will develop a computer graphics laboratory using a MicroVAX II computer, a high resolution display and five low resolution terminals. The laboratory will support both computer graphics courses and independent student study in this emerging area. Two student research projects are contemplated. One is to produce three dimensional images from two dimensional representing cross-sectional slices of biological specimens. The other is to produce three-dimensional, animated sequences. Emphasis in the courses and laboratory will be on the mathematics, physics, and computer science theories that form the basis of modern computer graphics.

COLLEGE SCIENCE INSTRUMENTATION

Jerry R. Mohrig
Carleton College
Northfield, MN

USE 8750210
FY87 $33,472
Chemistry

"Improving Undergraduate Instruction in Chemistry Through the Use of a Gas Chromatograph/Mass Selective Detector System"

A recently acquired, versatile, state-of-the-art gas chromatograph/mass selective detector (GC/MSD) is now being used in the undergraduate chemistry program at Carleton College. Direct student access to this sophisticated microcomputer-controlled instrument provides powerful motivation for students to follow careers in science. The system is used in both upper-level and introductory-level courses, including the junior-year integrated laboratory sequence, undergraduate research projects, organic chemistry, and the introductory chemistry laboratory. A significant fraction of the chemistry majors at Carleton are women.

COLLEGE SCIENCE INSTRUMENTATION

Mary Savina
Shelby J. Boardman
Carleton College
Northfield, MN

USE 8750682
FY87 $45,500
Geology

"Purchase of an X-Ray Diffraction Unit for Undergraduate Geology"

The Carleton College Geology Department will purchase a semi-automated x-ray diffraction unit. The diffractometer is needed by the Geology Department to teach modern x-ray techniques in mineralogy, soils, and advanced petrology courses. These classes will teach x-ray theory and practice in lectures and laboratory exercises. Virtually all geology majors take at least one of these classes. The diffractometer is also needed for student research projects, including senior integrative exercises required of each major.

COLLEGE SCIENCE INSTRUMENTATION

James S. Backer
Concordia College at Moorhead
Moorhead, MN

USE 8750632
FY87 $23,255
Biology

"Undergraduate Laboratory Equipment for Isolating DNA, RNA, Proteins and Lipids"

This equipment is providing the Biology Department with the ability to isolate DNA and RNA through ultracentrifugation. The microfuges are being used for the easy manipulation of small volumes (10-200 microliters) of RNA and DNA. Protein purification experiments and isozyme studies are being done in Cell Biology and in Plant Physiology using slab gel electrophoresis techniques which make cross sample comparisons easier than with tube gel electrophoretic systems. By working in the laboratory with DNA, RNA, and protein, the students gain hands on experience and greater insight into the major conceptual underpinnings of molecular biology and molecular genetics. In addition to its applications in six upper division courses, the equipment will support a newly instituted Honors Program in Biology.

COLLEGE SCIENCE INSTRUMENTATION

William H. Heidcamp
Gustavus Adolphus College
Saint Peter, MN

USE 8750085
FY87 $41,011
Biology

"Instructional Equipment for an Undergraduate Cell Biology Laboratory"

This project is improving undergraduate laboratories in all Biology by adding equipment to conduct the separation and characterization of macromolecules through centrifugation, electrophoresis, spectrophotometry and similar techniques. The Principal Investigator is developing a Laboratory Techniques Manual featuring "do-able" exercises for undergraduates at three levels: I, Basic Procedures; II, Intermediate Level Techniques; and III, Advanced protocols. His report of this work to the American Society for Cell Biology has elicited so favorable a response that prospects for this project's achieving a substantial national impact are encouraging.

Careful scheduling of the laboratories will permit the same instruments to contribute to modernization of the Department's teaching of Molecular Biology, Microbiology, Immunology, Genetics and Biochemistry, as well as serving their central function in Cell Biology.

COLLEGE SCIENCE INSTRUMENTATION

Karl W. Knight
Gustavus Adolphus College
Saint Peter, MN

USE 8852834
FY88 $31,115
Computer Science

"Artificial Intelligence Course Development Project"

This project permits students at this institution to study Artificial Intelligence (AI) as an interdisciplinary course - one involving both the principles of programming AI problem solutions as well as the study of issues of cognitive science. The new AI course is offered as a capstone course in that students develop one or two very complex LISP programs in the area of AI. The laboratory equipment that supports this project includes: networked Apollo DN3000 and DN 4000 workstations running LISP.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Steven Mellema
Gustavus Adolphus College
Saint Peter, MN

USE 8750140
FY87 $27,670
Physics

"Experimental Modern Physics Laboratory Development Project"

The Physics Faculty of Gustavus Adolphus College will develop a new junior-level course, Experimental Modern Physics Laboratory. This course will become the capstone laboratory in the sequence of introductory and intermediate classical physics and electronics laboratory courses, required of all majors. The principal goal of the new course is to provide majors with direct experience investigating important microscopic physical phenomena at an advanced undergraduate level using modern instrumentation and data acquisition equipment.

The focus of this project is the implementation of new and modernized experiments in nuclear and condensed matter physics and modern optics. The principal units to be developed are: a gamma-ray spectroscopy facility; an alpha-particle spectroscopy facility; a condensed matter (including low temperature) facility; and a set of modern optics experiments. In addition, four IBM PC-XT computers will be used to control experiments and to collect and analyze data.

COLLEGE SCIENCE INSTRUMENTATION

Olaf A. Runquist USE 8851429
Hamline University FY88 $9,705
Saint Paul, MN Chemistry

"The Introduction of Fourier Transform - Infrared (FT-IR) Analysis into the Chemistry Curriculum"

A Perkin-Elmer Model 1640 FT-IR spectrophotometer complete with a diffuse reflectance accessory and a graphics plotter has been acquired. The theory and practice of FT-IR analysis is being incorporated into the introductory organic course as well as five upper division laboratory courses. The instrument is also being used in undergraduate research. Specific course improvements include the enhancement and expansion of IR analysis in organic laboratories, the introduction of FT theory and instrumentation into analytical, as well as the extension of IR analysis to small samples and opaque materials and extensive demonstration of the FT-IR capabilities as both a qualitative and quantitative tool.

The grantee is matching the award from non-Federal services.

COLLEGE SCIENCE INSTRUMENTATION

Kenyon Latham USE 8853099
Lakewood Community College FY88 $6,670
White Bear Lake, MN Chemistry

"Instrumentation and Laboratory Improvement in Undergraduate Chemistry"

The quality of undergraduate instruction in Organic Chemistry and General Chemistry is being improved through the acquisition and upgrading of equipment. Major instruments being added are a gas chromatograph (GC) system, a high-pressure liquid chromatograph (HPLC) system, and Apple IIgs computer system and an interactive microware (IMI) data acquisition system. The instruments are enhancing the implementation of the microscale laboratory program and are complementing each other in analytical capabilities, increasing student access to modern equipment, familiarizing them with computer acquisition, storage and manipulation of data, and introducing them to HPLC. Chemical instrumentation is being treated as a an integral part of the laboratory work, thereby strengthening the quality of the learning. Laboratory activities such as kinetic studies, competitive reactions, and determination of product distribution ratios is allowing students to actually collect data instead of only seeing it in a text book. The project is significantly impacting the quality of science education for a group of students in a community college that serves not only as a lower division program, but also to educate employees in a 10-mile circle of science based corporate neighbors.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Daniel J. Hornbach USE 8750483
Macalester College FY87 $17,773
Saint Paul, MN Biology

"Equipment for an Undergraduate Field Station Laboratory to Provide On-Site Instruction in Terrestrial and Aquatic Ecology"

The Biology Department is unusually fortunate in owning a 300-acre field station located within 20 miles of the main campus. The field station contains a number of different terrestrial and aquatic habitats: prairies and forest, ponds and river. Located at the field station is a laboratory building staffed by a resident naturalist. The field and laboratory equipment provided through this award are making this field station self-sufficient and more fully functional.

The new field equipment includes soil and water test kits; the laboratory equipment includes microscopes, balances, drying ovens, and a microcomputer for data storage and analysis. Since the station already has adequate dormitory space, the addition of a fully equipped laboratory allows students to live and conduct meaningful research on site. The equipped station laboratory is particularly valuable during the January interim term when students may study a single topic in depth. With guidance from the resident staff and from the two Ph.D. ecologists on the Biology faculty, the field station now is able to introduce substantial numbers of undergraduates to a high degree of sophistication in studying ecological research methods.

COLLEGE SCIENCE INSTRUMENTATION

Daniel J. Hornbach USE 8852273
Macalester College FY88 $41,586
Saint Paul, MN Biology

"An Undergraduate Computer Laboratory for the Biological Sciences"

Computer technology is playing an increasingly important role in the biological sciences. Computers are being used for data acquisition and analysis, and they make the simulation of complex biological systems possible. Despite their importance, the integration of computers into the undergraduate Biology curriculum has not been consistently achieved. This means that students often underestimate the need for quantitative skills in modern biological research.

This project attempts to overcome this problem by developing a computer laboratory for the biological sciences. The laboratory is being configured with a network of 12 MacIntosh II computers to allow for interaction among the instructor and students. One of the main uses of the lab is to allow students to develop their analytical skills by designing simulation models of biological processes. Simulations are used in the department's Ecology, Limnology, Human Physiology and Research courses. The new equipment also supports the development of an Evolution course in which the majority of the labs are to be based on model building. In addition, the lab is used by students in a number of classes to acquire data from scientific instruments and to conduct the subsequent statistical analyses of these data. Finally there are plans to use the computer lab for literature searching and accessing external databases through the college's local area network.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Walter D. Mink	USE 8851719
Macalester College	FY88 $13,304
Saint Paul, MN	Psychology

"Computer Laboratory for Cognitive Science Information"

Necessary hardware and software has been assembled to provide laboratory support for a new course, Introduction to Cognitive Science. Cognitive Science is a set of problems common to the disciplines of Psychology, Linguistics, Philosophy, and Artificial Intelligence. A strong role is played by computing in this emerging multidisciplinary enterprise and a strong laboratory component is essential to an introductory course. A cluster of four computer workstations, a laser printer, and the means to link them into an integrated system as well as to tie them into a campus wide network have been provided by the award.

The award will be matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Gerald R. Pitzl	TPE 8751337
Macalester College	FY87 $138,187
Saint Paul, MN	Geography

"The Minnesota World Regional Geography Course Project"

The Geography Department at Macalester College will host its third geography teachers' institute from July 6 to July 24, 1987. The institute will host 30-35 teachers of geography and social studies (grades K-12) in an intensive three-week workshop. Preference in admission will be given to teams of teachers--one elementary and one secondary--from the same district. Participants will earn eight semester-hours of graduate-level credits.

The teachers will receive instruction in a wide array of geographical themes and concepts aimed at enhancing geography education in Minnesota. Instruction will be provided by two Macalester geographers and augmented by a staff of classroom master teachers and invited professional geographers and applications specialists. All teachers will produce six modules of instruction designed for classroom use and including salient aspects of the materials introduced in the institute. In addition, they will be required to give two in-service workshops in their home districts on the new materials during the 1987-88 school year.

The first week of the summer institute will emphasize local geography, map and graphic skills, use of air photos, and computer application. The second week will deal with the concept of the region. In the third week, attention will be drawn to global patterns and processes. Both concept and skill development will be emphasized.

A number of local field trips will be taken to introduce teachers to ways of using local resources in their own areas and to teach effective observational and questioning techniques. In addition, a number of visits to museums and libraries are scheduled.

The teachers are required to attend four full-day follow-up sessions scheduled for September, November, February and April of the following academic year. During these sessions, new materials will be reviewed and the teachers will share information about their classroom experiences using the modules developed as part of the institute.

COURSE AND CURRICULUM

A. Wayne Roberts
Macalester College
Saint Paul, MN

USE 8813914
FY88 $62,650
Mathematics

"Calculus Reform in Liberal Arts College"

Mathematicians from 25 cooperating liberal arts colleges in the Midwest will plan to develop a one-year, mainstream Calculus course. These colleges are members of the Great Lakes Colleges Association and the Associated Colleges of the Midwest.

Their curriculum will stress: basic concepts; numeric and graphic experiments to better understand the power and limitations of technology; role that calculus played in changing people's world view; art of writing a deductive argument; applied mathematics as a creative modelling process.

Outlines of teaching resources to create a lean and lively one-year Calculus course will include: sequences of laboratory style problems; textbook type problems for computers/calculators; application modules; open ended problems; and historical vignettes.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

COLLEGE SCIENCE INSTRUMENTATION

G.Michael Schneider
Richard K. Molnar
Macalester College
Saint Paul, MN

USE 8853215
FY88 $39,186
Computer Science

"An Introductory Computer Science Laboratory"

In addition to revising the course content of Introductory Computer Science, this project revises the computer science laboratory experience so that it is highly structured.

Unlike the laboratory component of physical and natural science courses, computing labs tend to be informal. Students are given programming assignments which they complete on their own time. Frequently, laboratory sessions are not scheduled. This project introduces a highly structured lab into the introductory course where a large screen projection system is used to give demonstrations and preplanned lab activities are designed to clarify a concept, demonstrate and idea or teach a skill. The laboratory hardware consists of Macintosh II computers that are networked, the software is the UNIX operating system and Turbo Pascal.

This project also substantially revises the Introductory Computer Science course content in the courses for both non-majors and majors. The course for non-majors, rather than being the typical "appreciation" course, is an integrated survey of the fundamental and central principles of computer science. For example, students are exposed to a Turing Machine simulator where they can observe and experiment with this model. The course for majors is revised from being only a programming course to one where students are exposed to a vast collection of software development resources such as: syntax-directed editors, hierarchical file systems, windowing systems, code profilers, optimizers, assertion checkers, on-line documentation and help packages, and network mail.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Paul F. Brown
Mankato State University
Mankato, MN

USE 8853333
FY88 $11,456
Anthropology

"Establishment of a Physical Anthropology Laboratory"

Laboratory training is a fundamental aspect of good physical anthropology training. This award permits the purchase of needed equipment for a new physical anthropology laboratory. The courses utilizing this equipment include, Introduction to Anthropology, Human Origins, Human Skeleton, Health Culture and Disease, and Physical Anthropology Laboratory. The pathology material is used in the areas of pathological processes of bone and forensic analysis. The skeletal material is used for identification of parts of the skeleton and the landmarks and features of individual bones. The microscopes are used for the study of bone histology. The anthropometric instruments are basic tools required for anthropometry. They are used to demonstrate variability by age, sex, and breeding population.

The award will be matched by an equal amount from the grantee.

TEACHER ENHANCEMENT PROGRAM

John E. Frey
Mankato State University
Mankato, MN

TPE 8651998
FY87 $104,491
FY88 $100,455
Biology

"Biotechnology Research Seminars for Leaders in Secondary School Science Education"

This teacher enhancement project will increase the expertise of 20 high school biology teachers per year in the areas of biotechnology, biological research, problem solving, and scientific writing. These twenty teachers will return to their schools, following a 6-week summer program, to enrich their instructional program, to provide inservice experiences for their colleagues, and to exert leadership in curriculum reform and laboratory development. Teachers will be selected from school districts in the upper midwestern states of Minnesota, Wisconsin, Iowa, North and South Dakota. Follow-up activities will assist the teachers in both their instructional modifications and leadership activities.

Teachers selected meet in the spring to consider their summer research project with the appropriate college faculty. The project is planned and partially developed by the time they arrive for the summer. During the summer, in addition to working on their project, they attend seminars on contemporary topics in biology and develop activities for their own classrooms related to both the research activities and seminars. In addition, they develop the outline for the inservice activities which they will conduct. During the academic year, university staff make visits to the participant's schools and conferences are held at the University or other appropriate settings to further the knowledge of teachers or to report research results.

The proposal is an outgrowth of an honors workshop for high school teachers conducted during the past two years. The PI is a research biologist, but also has experience directing teacher development activities. The other staff members are research biologists from the University. Experts in biotechnology from the private sector will be used as speakers and consultants.

COLLEGE SCIENCE INSTRUMENTATION

Cecil S. Keen	USE 8852174
Mankato State University	FY88 $34,299
Mankato, MN	Atmospheric

"Improvement of the Undergraduate Atmospheric Science Curriculum in Geography with Equipment for Real-Time Meteorology"

This university will purchase equipment to use satellite imagery, weather radar data, National Weather Service information, lightning strike data, and local weather data to enhance instruction in several undergraduate courses. These include both large introductory courses in physical geography and weather; and more specialized courses in climatology, advanced weather analysis and remote sensing. Students will have the opportunity to engage in a number of "hands-on" projects that utilize data obtained with this equipment. The lower division courses serve significant numbers of K-12 teacher candidates.

The grantee will match the NSF equipment award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Steven D. Mercurio	USE 8750844
Mankato State University	FY87 $41,628
Mankato, MN	Biology

"A Gas Chromatograph/Mass Spectrometer for Undergraduate Instruction in an Interdisciplinary Toxicology Program"

This grant has provided the Department of Biology a Hewlett-Packard capillary gas chromatograph (GC) linked to a mass spectrometer (MS) with a direct insertion probe that is being used to facilitate instruction in Toxicology courses and to facilitate the development of more interdisciplinary undergraduate science projects. Since the MS is an essential tool in the qualitative and quantitative structural analysis of unknown toxicants in the environment, projects have been designed in six courses to teach how the GC/MS functions, and how it is used in Toxicology and in other areas of the Biological and Physical Sciences.

Experiments have been developed to exploit the advantages offered by the GC/MS as well as show the disadvantages of inappropriate use (e.g. unstable antibiotics injected into a GC/MS versus direct insertion into the MS). Student projects involve the use of the GC/MS to detect environmental pollutants and unknown metabolites of well-defined toxic chemicals or medications. Stable isotope analyses, potentially useful to those pursuing human nutritional toxicology research, and experiences with new methods for using the GC/MS (e.g. with theoretical, pure standards and with biological sample spectra) are providing instruction on uses of a low resolution GC/MS in Toxicology.

COLLEGE SCIENCE INSTRUMENTATION

Bertha L. Proctor	USE 8851174
Mankato State University	FY88 $29,865
Mankato, MN	Biology

"An Atomic Absorption Spectrophotometer/Graphite Furnace for an Undergraduate Interdisciplinary Environmental Science Program"

This department stresses a program of quantitative training to help undergraduates develop skills necessary for biologists and environmental scientists in the next decade. A Perkin-Elmer 5100 Atomic Absorption Spectrophotometer-Graphite Furnace (AA-GF) system with Zeeman background correction is facilitating instruction in Biology Department programs, including Environmental Sciences, Toxicology, Microbiology, and Botany, and is encouraging development of more interdisciplinary undergraduate courses and projects.

The AA and GF are essential tools for the quantification of metals in a variety of matrices. Projects have been designed in five courses to instruct students in the theory, advantages, limitations, and proper uses of AA and GF. Instrumentation maintenance and quality control/quality assurance procedures are an integral part of all courses and projects. Student projects involve use of the AA and, where appropriate, the FA as detectors of metal contaminants in water, soil/sediments, biological fluids, tissues, and air. They also are used to measure bioaccumulation of metals in terrestrial/greenhouse studies and to monitor the levels of toxic metals added to tissue cultures for chronic and acute toxicity testing. Research and development of new methods for use of the GF and AA should give complete instruction of uses, advantages, and limitations of these tools.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Theresa A. Salerno
Mankato State University
Mankato, MN
USE 8750845
FY87 $22,274
Chemistry

"Development of Biochemistry Laboratory Curriculum"

The Department of Chemistry and Geology at Mankato State University has recently acquired a high speed centrifuge and a liquid scintillation counter for use in the improvement of undergraduate instruction in biochemistry. The major objective is to revitalize the biochemistry program by implementing a senior level "project oriented" laboratory course. In this course, students learn to work as a team to solve a specific research problem involving the characterization of a plant RNA virus. The students design an experimental strategy to solve the assigned problem including learning how to use the literature, planning and organizing experiments, performing a wide range of preparative and analytical biochemical techniques, and interpreting and communicating data.

COLLEGE SCIENCE INSTRUMENTATION

Christine E. McLaren
Moorhead State University
Moorhead, MN
USE 8851944
FY88 $29,157
Mathematics

"Instructional Computer Laboratory for Introduction to Statistics"

This project will implement an IBM microcomputer laboratory for two elementary statistics courses requiring a background in algebra and courses for pre-college teachers. With the use of the statistical package MINITAB, eleven hundred students per year will do real world exploratory statistical analysis, look for patterns and relationships, confirm or disprove the expected, and discover new phenomena. Problems using real data from accounting, agriculture, economics, management, marketing and medicine will be used.

The primary impact on the secondary mathematics majors and elementary education majors will be development of computer skills necessary for classroom teaching, concepts of probability and descriptive statistics.

The principal investigator is a biostatistician with publications in computer assisted analysis.

The grantee is providing an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

David K. DeGroote
Saint Cloud State University
Saint Cloud, MN
USE 8750520
FY87 $24,292
Biology

"Instrumentation to Develop an Analytical Chromatography Laboratory for Undergraduate Biology"

With the high performance liquid chromatograph and gas chromatograph procured through this project, undergraduates in this Department are integrating theory and practical experience through applying the techniques of separation technology across a wide range of biologically important classes of chemicals. Naturally occurring or synthetic substances in the environment are discussed and are being identified or quantitated by laboratory procedures that are presented in a broad spectrum of courses.

Providing hands-on laboratory experience brings a depth of understanding of modern Cellular/Molecular Biology and Biochemistry that cannot be conveyed through lectures alone.

COLLEGE SCIENCE INSTRUMENTATION

Janet C. Woodard
Denise M. McGuire
Saint Cloud State University
Saint Cloud, MN
USE 8852090
FY88 $11,152
Biology

"Instrumentation to Develop an Undergraduate Immunology Program"

The Department of Biological Sciences is committed to teaching students an understanding of biology through participation in scientific experimentation. In addition to a better understanding of science, participation in the process of science teaches students valuable skills for today's job market. To meet the increased need for graduates who can bring an understanding of immunology to their advanced studies as well as Minnesota's growing biotechnology industry, the Biology department currently is updating and expanding this area of its curriculum. This is being achieved by hiring a new faculty member with up-to-date knowledge in immunology and purchasing an initial suite of equipment.

The goal of this project is to complement the original equipment purchases with items commonly used in modern immunological technology. This allows the Department to offer a program in immunology that aids students in their understanding of biology and also prepares them for employment opportunities in local industry.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Michael R. Ross	USE 8851849
St. John's University	FY88 $48.250
Collegeville, MN	Chemistry

"Integration of Gas Chromatography/Mass Spectrometry into the Undergraduate Chemistry Curriculum"

Gas chromatography/mass spectrometry (GC/MS) is being incorporated into the undergraduate Chemistry curriculum at both St. John's University and the College of Saint Benedict. The mass spectrometer is being interfaced with a gas chromatograph which was previously present. The new system is being used to illustrate the principles and techniques of MS or GC/MS in the organic, physical, advanced analytical, and advanced inorganic courses, as well as student research. All of these areas are being expanded and enhanced by the acquisition of the mass spectrometer. Students are gaining a first hand knowledge of the diversity of applications for a GC/MS system.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Richard V. Kowles	USE 8852046
St. Mary's College	FY88 $15.529
Winona, MN	Biology

"Standard and Fluorescence Cytophotometry Equipment for the Undergraduate Curriculum and Student Research"

This Biology Department has identified an opportunity to improve and diversify its laboratory capabilities in five upper division biology courses and in the undergraduate student research program. This entire array of objectives will be met by the acquisition of the components needed to build upon and complete a sophisticated cytophotometer system with fluorescence capabilities; that is, a functional unit which the Department had previously begun to assemble with their own resources.

The added laboratory activities will include measurements of DNA content, cell cycle studies, and chromosome analyses in genetics; cytochemistry and fluorescence microscopy in cell biology; fluorescence cytophotometry and biotinylated DNA hybridization in molecular biology; microbe identification in microbiology; indirect fluorescence and direct immunofluorescence in immunology; and a number of qualitative and quantitative techniques and additional undergraduate research options. Scientific advances in certain aspects of biology which heavily utilize these techniques coincide very well with the nature of the curriculum, faculty expertise, and student interest here.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Donald R. Morgan	USE 8851415
St. Mary's College	FY88 $8,300
Winona, MN	Physics

"Modernization of Optics Experiments in Advanced Undergraduate Labs"

This project includes purchase of an optical bench, a 5 mW He-Ne laser and associated optics, a photodiode array, an interferometer system, a fiber optic system, and a holographic system. This equipment will be used to improve instruction in the Advanced Physics Laboratory course by permitting the addition of several new experiments in modern optics. These experiments are designed to give students training in the use of modern optical equipment as well as improving their understanding of the basic physical phenomena.

The grantee will match the NSF award with an equal amount of funds.

YOUNG SCHOLARS

Eugene B. Bakko	RCD 8850056
Kay Smith	FY88 $84,705
Wesley A. Pearson	HS Science
James Cederberg	
Kathleen Fishbeck	
St Olaf College	
Northfield, MN	

"Science in Action"

Thirty sophomore and junior high school students participate in a two-week residential program designed to accomplish four objectives: (1) teach fundamental principles involved in biology, chemistry, physics, mathematics, and psychology, (2) explore research in one discipline in depth,

(3) achieve understanding of ethical considerations scientists face, and (4) explore career options in the sciences. Activities include lectures, laboratory exercises and involvement in on-going faculty research.

Follow-up activities include student presentations based on their Young Scholars workshop experience to students and teachers in their home schools.

COLLEGE SCIENCE INSTRUMENTATION

Alice J. Burton USE 8750343
St Olaf College FY87 $21,670
Northfield, MN Biology

"Undergraduate Laboratory Equipment for the Teaching of Genetics"

The equipment provided through this award is improving the undergraduate laboratory for students enrolled in the intermediate-level Genetics course. One set of experiments is based on recombinant DNA technology (especially as it is applied to the sequencing of DNA), while a second set emphasizes gene product isolation and the genetic control of development. The work on recombinant DNA technology includes a number of steps which can be carried out conveniently in the structured laboratory setting. The essential simplicity of the experiments provides an experience which clarifies the section of the lecture program which emphasizes molecular genetics. These steps also introduce the students to several widely used physical methods (e.g., agarose and acrylamide gel electrophoresis, ultracentrifugation) and incorporate such standard biological techniques as transformation and replica plating in relevant ways. Gene product isolation from Drosophila melanogaster and Caenorhabditis elegans introduces students to the biology of these widely studied organisms and to the characterization of proteins.

The additional equipment secured through this award (electrophoresis units, high voltage power supply, microcentrifuge, sonicator, shaker bath, gel slab dryers, ultracentrifuge and rotor) permits students to perform these experiments in their logical order (rather than having the order imposed by equipment availability), in this way gaining an understanding of the many applications of molecular techniques to solving basic questions in Genetics.

COLLEGE SCIENCE INSTRUMENTATION

James F. Dickson USE 8851795
St. Olaf College FY88 $18,106
Northfield, MN Psychology

"Development of Interactive Laboratory-Classroom in Psychology"

This project establishes an interactive microcomputer laboratory classroom in Psychology. It impacts all majors in Psychology, exposing students to the use of the microcomputer as an integral part of the research enterprise in Psychology.

Student experiences include the use of microcomputers for programming of experimental contingencies, stimulus presentation, data collection and statistical analysis with human and animal subjects. For those phenomena which cannot be directly studied, simulation programs are used. Twelve microcomputers and ancillary equipment serve a variety of courses and over 100 students per year.

The laboratory is available for advanced student research projects as well. The provision of software for sharing information and documents should impress students with the many effective alternatives for developing research ideas, exchanging experimental data and communicating the results of their research investigations. This new facility represents a critical and significant new direction in the Psychology program. The award will be matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

George L. Hardgrove, Jr. USE 8750342
St. Olaf College FY87 $29,278
Northfield, MN Chemistry

"Polymer Chemistry in the Physical Chemistry Laboratory Using a Differential Scanning Calorimeter and Gel Permeation Liquid Chromatography Equipment"

The inclusion of more polymer chemistry in the standard physical chemistry laboratory course is among the added capabilities provided by the recent acquisition of a differential scanning calorimeter and gel permeation liquid chromatography equipment at St. Olaf College. Gel permeation is being used to determine the molecular weight distribution of polymers while phase changes in polymers are being studied via differential scanning calorimetry. These experiments are complemented by a study of copolymer composition using NMR and Fourier Transform Infrared Spectroscopy.

COLLEGE SCIENCE INSTRUMENTATION

Alan Magnuson	USE 8851796
St. Olaf College	FY88 $14,680
Northfield, MN	Mathematics

"Integration of Computer Tools into Classroom Mathematics Instruction"

The Department of Mathematics plans to integrate symbolic, numerical, and graphical computing tools into all courses in its Mathematics curriculum via an electronic blackboard. Department faculty will develop course materials, software, and documentation.

Four classrooms will be equipped with a micro computer and large screen projector. With well developed software tools and the means for using them in a classroom, the lecturers will communicate a more accurate picture of the nature of Mathematics and its ideas.

The Department has been in the forefront in the development of materials for and in the use of symbolic manipulators in Calculus curriculum.

The grantee is providing in equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Duane N. Olson	USE 8750344
St Olaf College	FY87 $17,469
Northfield, MN	Physics

"Electronic Instruments and Peripherals for a Computerized Physics Laboratory"

The Physics Department at St. Olaf College is in the process of modernizing its introductory and advanced laboratories. The instrumentation to be acquired will greatly increase access to computers for data acquisition, analysis and display. A variety of instruments, with stand-alone capability as well as computer access, will give access to state-of-the-art electronic devices. These include: a digital multimeter, a digital storage scope, a versatile function generator, and a power supply; all with GPIB capability. The computing equipment will include terminals (with and without graphics capability) to allow greater access to existing multi-user computers, and a PC/AT compatible with high resolution color graphics, plotter, interfacing cards, and software for data acquisition and analysis. The large introductory laboratory sections will benefit from the addition of four microcomputers, with bit-mapped graphics capability, to give access to a routine already developed for data analysis. Two printers will supply hard-copy of the results. A number of electronics and advanced laboratory experiments will take advantage of the greater precision or speed of access to examine topics of fundamental interest, but not generally accessible with conventional instrumentation.

TEACHER PREPARATION PROGRAM

Patricia M. Heller	TPE 8850630
Fred N. Finley	FY88 $389,720
University of Minnesota	FY90 $102,275
Minneapolis, MN	Elem Science

"A Model for Improving the Preservice and Inservice Science Education of Elementary School Teachers"

The University of Minnesota will develop and evaluate a model for upgrading the preparation of prospective elementary teachers in science and science teaching in the State of Minnesota. Six pairs of faculty, one physical scientist, and one science educator, from Minnesota colleges will cooperate in a nine-week workshop. They will examine theories of conceptual change, develop and teach a three-week workshop for lead elementary school teachers from public and private schools near their home institutions, and develop plans for improving their own physical science and science methods courses. The workshop will provide the opportunity for faculty to change their own conceptions of teaching science as they put new ideas into practice. It will also produce a set of practicing elementary school teachers who espouse the same philosophy who will be able to support preservice teachers during field experiences and student teaching. During the following two years, the faculty pairs will assist their local lead teachers in implementing changes in their own districts. Similarly, they will be assisted by the project staff and each other as they plan and implement new courses in science and science methods for preservice teachers. The efforts of the faculty pairs will be studied during a comprehensive evaluation that will reveal the strengths and weaknesses of the model.

This project should improve the teacher preparation programs of six colleges and at the University of Minnesota. In addition, it will influence how science is taught in elementary schools in the districts in which the colleges are located. The total cost sharing for the project from school districts and from the University of Minnesota is $228,590 or 31.5% of the total project cost.

TEACHER ENHANCEMENT PROGRAM

Roger T. Johnson	TPE 8751338
David W. Johnson	FY87 $275,978
Karl A. Smith	FY89 $265,474
University of Minnesota	Other NEC
Minneapolis, MN	

"Training Science and Math Teachers in Cooperative Learning"

Structuring classrooms in which students work cooperatively rather than compete or work individualistically has been shown to be powerful in several key ways. Cooperative learning groups produce a learning environment where more students learn more material, students are more positive about the subject area and more motivated to take additional classes. In addition, there is an acceptance of differences which encourages the achievement of both males and females, handicapped and non-handicapped, students of different ethnic backgrounds, and students who do not have English as a native language.

The goals of the project are to train leadership teams of science and mathematics teachers in school systems where cooperative learning has already been introduced and to initiate basic training in cooperative learning in other prominent school systems, including at least two inner city sites. Over 600 mathematics and science teachers from eleven key school districts across the United States will be trained in how to structure cooperative learning groups in their science classrooms. In addition, a model for building cooperative learning into already existing curricula in science and mathematics will be developed and implemented.

TEACHER ENHANCEMENT PROGRAM

Harvey B. Keynes	TPE 8470365
University of Minnesota	FY85 $201,288
Minneapolis, MN	FY86 $204,886
	FY87 $172,647
	Mathematics

"A Model for Mathematicians to Impact Precollegiate Mathematics"

In this project 100 superior mathematics teachers will participate in an intensive summer program intended to both upgrade their existing content knowledge and to provide an introduction to new topics. Teachers will choose one course from among courses in computer science, geometry, problem solving, calculus or probability/statistics. Each course will meet 4 hours per day for 20 days. Selected teachers will also participate in monthly seminars during the academic year.

This project will be led by a group of outstanding mathematicians including Dr. Keynes. The project staff has experience as high school mathematics teachers and in developing programs for mathematics teachers. The project will lead to more knowledgeable and skilled mathematics teachers. Each applicant's school has agreed to permit the participating teacher to use model lessons developed in the summer in his or her classroom and to allow participants to provide in-service training to other mathematics teachers within their schools.

NETWORKS PROGRAM

Harvey B. Keynes	TPE 8550590
University of Minnesota	FY86 $76,332
Minneapolis, MN	FY87 $67,736
	FY88 $62,646
	Mathematics

"Minnesota Mathematics Mobilization"

Minnesota Mathematics Mobilization is a statewide effort to broaden communication among mathematics teachers, leaders in research and industry, and governmental officials about issues concerning precollege mathematics education. It is intended to increase support for mathematics education in the state, to provide a statewide forum for discussion of mathematics education, and to provide a link between Minnesota mathematics education efforts and related national projects. The Mobilization will integrate resources into an effective human system of experts, making existing knowledge available to anyone who has need of it.

Specifically, the Mobilization will undertake the following activities:

1. Establish a statewide newsletter containing information on math education in Minnesota.
2. Hold several statewide meetings each year.
3. Establish a centralized statewide information resource (e.g., an "800" telephone number) to put teachers in touch with persons who could help with mathematical concerns.
4. Identify and support resource individuals in mathematics and mathematics education who are willing to provide help to others.
5. Provide public information, position papers, and expert testimony to inform diverse audiences about mathematics education.
6. Promote the growth of speaker bureaus, monitored by regional contact persons in various sectors of the state.

TEACHER ENHANCEMENT PROGRAM

Thomas R. Post	TPE 8652341
University of Minnesota	FY87 $201,405
Minneapolis, MN	FY88 $140,418
	Mathematics

"Developing Leadership - Middle School Mathematics Teacher Education Project"

This two-year urban and rural project will:

- design and pilot test an instrument to collect data to determine middle school teachers' comprehension of middle school mathematical concepts and to construct mathematical profiles of these teachers;

- use this instrument to conduct the interviews of urban and rural middle school teachers;
- construct in-service mathematics institutes, for teams of elementary school teachers and principals, based on the teachers' profiles and the principal investigator's research on proportional reasoning and problem solving abilities of children;
- run the newly designed summer institute with academic year follow-up in the urban and rural settings in which the teachers were tested.

The principal investigators are Professor Thomas Post of the University of Minnesota and Professor Merlyn Behr of Northern Illinois University. The PIs will administer two types of written examinations and one oral interview to teachers from the Minneapolis, Minnesota and DeKalb, Illinois areas. The examination topics will include concepts of number and arithmetical operations, rational numbers, proportional reasoning, geometry, probability and statistics, pre-algebra, problem solving and technology.

The PIs will develop and select those learning activities for the teachers' institute which focus on higher order thinking skills and understanding processes related to mathematical teaching. The summer institutes will run during the summer of 1988. The academic year follow-ups include several on-site visits and mini-conferences.

COLLEGE SCIENCE INSTRUMENTATION

Ali R. Delavari	USE 8851460
University of Minnesota Duluth	FY88 $87,865
Duluth, MN	Computer Science

"Equipment for Signal Processing/Communication Laboratories"

This project permits undergraduate students to have hands-on experiences with state-of-the-art equipment in this institution's signal processing and communications laboratory. The laboratory that supports this project includes: HP Spectrum Analyzers, Wavetek function generators, Tek digitizing oscilloscopes, TI Digital Signal Processing 320's, Tandy 4000's with hard disks, color monitors and graphics display adapters.

Using this laboratory equipment, students obtain a solid background in linear systems, signal processing and communication systems as well as experience with the tools they will use in industry.

This award is being matched by an equal sum from the grantee.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

A. Dean Hendrickson	MDR 8550460
University of Minnesota Duluth	FY86 $140,402
Duluth, MN	FY88 $ 25,987
	Mathematics

"Meaningful Mathematics - An Activity Program, K-6"

This project will develop innovative materials for grades K-6. Instead of traditional textbook-lecture method of instruction, the children have direct and active experience with manipulatives and worksheets, in individual and small group work patterns. The sequence of exposition is different from the traditional, e.g., fractions and geometry both begin in kindergarten, and functions in grade four. The materials have been extensively tried and tested.

COLLEGE SCIENCE INSTRUMENTATION

Deborah E. Samkoff	USE 8852907
Brian Groh	FY88 $17,803
University of Minnesota Duluth	Chemistry
Duluth, MN	

"Fourier Transform Infrared Spectrometers for Undergraduate Instructional Laboratories"

Two Fourier Transform Infrared Spectrometers and required sample cell are being purchased for use in undergraduate Organic Chemistry, Physical Chemistry, Structural Chemistry, and Integrated Laboratory courses. The instruments are replacing outdated, failing equipment previously in use, allowing the conversion of the organic laboratory courses to microscale work, allowing students in the physical chemistry and integrated laboratories to obtain and analyze high-resolution IR data, and allowing students in the Structural Chemistry course to undertake more sophisticated identification problems than were previously feasible.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Donald R. Zrudsky	USE 8851816
University of Minnesota Duluth	FY88 $37,707
Duluth, MN	Electrical Eng

"Teaching Programmable Instrumentation Control"

This project exposes undergraduate students to advanced graphical instrumentation control techniques. The laboratory supporting this project includes Macintosh II computers, special hardware interfaces, Labview (TM) software and a collection of oscilloscopes, function generators, multimeters and other accessories. Using these configurations students carry on instrument control via a user-friendly graphical programming technique, transform data to their exact requirements, and tabularize and graph results in an integrated environment.

This laboratory not only serves students in the existing Computer Engineering Controls Laboratory but also non-computer-majors from the College of Science and Engineering who need to be involved in computer controlled instrumentation and students who wish to carry on projects and independent study in a laboratory environment.

This award is being matched by an equal sum from the grantee.

YOUNG SCHOLARS

Joseph J. Latterell RCD 8850062
University of Minnesota Morris FY88 $33,142
Morris, MN FY89 $33,142
HS Science

"Summer Education Experience--1988"

Project SEE 1988 is an intensive 8 week (June 13-August 5) program designed to introduce 12 senior high school students to collegiate level course work in the disciplines of chemistry, life science, earth science and computer science. Activities include laboratory techniques and procedures, independent research opportunities, discussions of ethical perspectives on scientific inquiry and career exploration in the sciences. The selected students live on campus forming a learning community with faculty mentors.

COLLEGE SCIENCE INSTRUMENTATION

Kerry G. Williams USE 8750609
Winona State University FY87 $17,392
Winona, MN Psychology

"Psychology Experimental Methods Lab"

The objective of this project is to increase the quality of laboratory science education in psychology at Winona State University. The focus of the project is on instruction in experimental design and research methods with applications in the areas of learning, cognition and sensation and perception. The equipment requested will provide for a state of the art experimental psychology laboratory. The equipment includes a computer controlled operant conditioning system with eight student lab stations. This equipment will permit students to conduct experiments in a variety of basic learning processes. Also requested are twelve personal computers which will provide the means for conducting a number of experiments in perception, cognition and learning. The equipment will facilitate instruction by giving students first hand experience with a variety of experimental research methods in scientific psychology.

MISSISSIPPI

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Sandra H. Harpole
Science
West Point High School
West Point, MS

Karen Fayard
Mathematics
Biloxi High School
Biloxi, MS

1988

Nellie Epps
Mathematics
Starkville High School
Starkville, MS

Patsy H. Johnson
Science
Jumpertown High School
Booneville, MS

COLLEGE SCIENCE INSTRUMENTATION

J.Paul Hollomon — USE 8750608
Delta State University — FY87 $12,580
Cleveland, MS — Chemistry

"Enhancement of General Chemistry through a Microcomputer Laboratory for Tutorial Work and Data Analysis"

A microcomputer laboratory consisting of eight microcomputers and associated software is being used in the general chemistry program at Delta State University for tutorial work and data analysis. Computer assisted instruction, in this setting, is being used to provide challenging experiences for advanced students and remedial work for those with educational deficiencies.

COLLEGE SCIENCE INSTRUMENTATION

Stephen F. Bollinger — USE 8852929
Jackson State University — FY88 $7,130
Jackson, MS — Psychology

"Microcomputer Assistance to Upgrade Physiological Psychology, Experimental Psychology and Statistics"

This project enriches the research experience of psychology students in Physiological Psychology, increases the sophistication of data analysis and experimental simulations in Experimental Psychology and assists the learning of statistics with supplemental computer assisted instruction. The equipment acquired, including microcomputers and instructional software, supports analogue to digital conversion, computerized data acquisition and signal averaging. With this award, an increased number of undergraduate students are being encouraged to pursue graduate education leading to academic and/or research careers in Psychology. Worthwhile research experiences and rigorous training in the basics of statistics and experimental design are vital to motivating and training students pursuing graduate education. The institution has a more than ninety percent minority enrollment. This award will be matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Bessie L. Tucker — TPE 8550976
Jackson State University — FY86 $136,321
Jackson, MS — FY87 $128,211
Mathematics

"Meeting Teachers - Mathematical Needs in the Modern Technology: A Mathematics Recruitment/ Recertification Program (MTRRP)"

This project will upgrade the mathematics skills and teaching techniques of teachers of grades K through 6. The project consists of courses and activities offered at two levels. Level I courses and activities are offered for teachers from grades K-3 and Level II courses and activities for teachers from grades 4-6. Twenty different participants will be selected for each of these two levels during both 1986-87 and 1987-88. Participants will be selected from within a 50-mile radius of Jackson State University.

The program for each level will consist of both academic-year workshops and a summer workshop. The academic-year component will consist of twelve evening sessions each semester and nine Saturday sessions. During the evening sessions the participants will work with course content and methodology. During the Saturday meetings the participants will discuss and share ideas regarding methods employed to effectively implement their experiences. Experts in the areas of teaching techniques and computer and calculator use will be invited as guest lecturers. Principals and superintendents will be invited to attend the Saturday sessions.

During the summer workshop, teachers will work one-on-one with elementary school students. Emphasis will be placed on recognizing individual differences and adapting teaching methods to such differences, on relating to learners with different interests and backgrounds, and on planning and using a variety of teaching methods.

YOUNG SCHOLARS

Margaret A. Wodetzki	RCD 8850102
Jackson State University	FY88 $47,245
Jackson, MS	FY89 $47,245
	Chemistry

"Future Scientists Program"

The School of Science and Technology of Jackson State University is sponsoring a Future Scientist Program for high potential secondary school students. The purpose of the program is to motivate young men and women toward research and teaching careers in science and mathematics. The program includes a residential summer enrichment program of six weeks at Jackson State University and follow-up activities involving the participants and their high school science teachers in the development of science projects during the academic year.

The summer program activities include an interdisciplinary study of the atmosphere and climate through classroom and laboratory activities and field trips, focusing on the disciplines of chemistry, biological science, atmospheric science, mathematics and computer science. The ethical aspects of the problems involved in the interaction between man and the atmosphere are examined. There are career exploration activities and close interaction with practicing scientists at Jackson State University and at cooperating agencies, industries and research laboratories.

The participants develop plans for projects related to the focus of the summer program, which can be carried out in their home schools during the academic year. Program staff work with the students and their local high school science teachers in the implementation of the projects.

COLLEGE SCIENCE INSTRUMENTATION

John W. Legg	USE 8750248
Mississippi College	FY87 $7,076
Clinton, MS	Chemistry

"Modern Gas Chromatography for an Instrument-Oriented Chemistry Program"

A computer controlled capillary gas chromatograph is being used by the Chemistry Department at Mississippi College for undergraduate instruction in organic, analytical, instrumental, and physical chemistry. Use of this instrumentation is correlated with that of other computer interfaced analytical instrumentation available in the department. There is a central focus on instruction in the theoretical and practical aspects of modern separation science.

COLLEGE SCIENCE INSTRUMENTATION

Edward J. Valente	USE 8851694
Mississippi College	FY88 $10,325
Clinton, MS	Chemistry

"Fourier Transform Infrared Spectroscopy for a Modern Chemistry Curriculum"

Consistent with the increasingly instrumental emphasis of laboratories in chemistry, the project is introducing Fourier Transform Infrared (FT-IR) spectroscopy into the undergraduate curriculum. Now, widely used for chemical analysis in academic chemical research, industry, forensics, and environmental monitoring, FT-IR spectroscopy is significantly improving the quality of the chemistry instrumental practice. Presently available are new, lower-cost yet high resolution instruments for FT-IR spectroscopy, appropriately and efficiently controlled by a micro computer for data collection, analysis, and presentation.

Incorporation of FT-IR spectroscopy is improving directly three areas of the undergraduate curriculum: Analytical, Organic Chemistry, and Instrumental Analysis; significant additions to the Physical Chemistry laboratory and enhancement of undergraduate research. The instrument is the only Fourier Transform spectroscopy instrument and is introducing the students directly to the utility of modern computer assisted time-domain instruments, and is allowing applications through educationally superior experiments.

The grantee is matching the award from non-Federal sources.

INFORMAL SCIENCE EDUCATION

Elizabeth S. Hartfield	MDR 8550940
Mississippi Museum of Natural Science	FY86 $40,182
Jackson, MS	FY87 $45,148
	FY88 $ 4,000
	Museums

"Museum Activities Coordinated with 3-2-1 CONTACT"

The Mississippi Museum of Natural Science (MMNS) will develop a program aimed at teachers and students in grades 3-7. The project will develop teacher kits and "hands-on" exhibits tied to the new state curriculum and to the science television series "3-2-1 Contact".

The MMNS is a division of the Mississippi Department of Wildlife Conservation and is designated as the official natural science museum by the State Legislature. The Museum has been in operation for 50 years and, since its inception, has served as a resource for classroom teachers. Mississippi has approximately 500,000 public school students attending about 1,000 schools. One third of these children are considered to live below the poverty level and 50 percent are from minority groups - a priority for the NSF.

The MMNS has had success with a small pilot project which coordinates science concepts taught in the television series "3-2-1 Contact" with exhibit programs at the Museum. Over the next two years MMNS will expand their "hands-on" exhibits and develop science kits for use in the classroom in coordination with the new state curriculum and the television series. The kits will include museum objects, suggested activities and a teacher's guide. During the first year a series of "Contact Days" will be held with teachers and students across the state to develop and test the effectiveness of the project along with a lecture program by minority and women scientists. During the second year the exhibits will travel to schools across the state.

The FY88 supplement will allow this museum project serving minority and low income children to retain the services of an experienced program consultant for coordination with Children's Television Workshop.

FACULTY ENHANCEMENT

Lida K. Barrett	USE 8850947
William T. England	FY88 $24,658
Mississippi State University	Undergraduate Educ
Mississippi State, MS	

"Conference on Undergraduate Science, Engineering and Mathematics"

A regional conference for mathematicians and engineers involved in undergraduate education was held on September 30 and October 1, 1988, in Memphis, Tennessee. The conference was jointly hosted by Memphis State University, Mississippi State University, and Tennessee State University. Attendig were more than 200 representatives of colleges and universities in the Southeastern Region, consisting roughly of East Texas, Arkansas, Tennessee, Louisiana, Georgia, Kentucky, Mississippi, Alabama, Southern Illinois, and Missouri. The conference goals were three-fold: (1) to provide a series of presentations on the ways in which undergraduate mathematics programs are being changed to take advantage of computer symbolic manipulations capabilities, (2) to explore the needs and strategies for engineering education especially at the Historically Black Colleges and Universities in the region, (3) to provide an overview of National Science Foundation support for curriculum development in science, engineering, and mathematics at the undergraduate level. From the conference presentations, a paper on the use of computer algebras will be prepared and submitted for publication in the NOTICES of the American Mathematical Society and in FOCUS, the newsletter of the Mathematical Society of America. A second paper on the role of the Historically Black Colleges and Universities in engineering education will be submitted for publication in the newsletter of the American Society of Engineering Education.

TEACHER ENHANCEMENT PROGRAM

James R. Bryson	TPE 8751739
Three Rivers Reg Education Service	FY88 $420,541
New Albany, MS	Mathematics

"Mathematics Improvement Initiative"

This is a three-year project aimed at the elementary and junior high school teachers in six Appalachian counties of northeast Mississippi. The project involves administrators, supervisors, coordinators, and teachers from 52 schools representing 14 rural school districts. The administrators receive the equivalent of three full days of orientation and instruction to give them familiarity with the trust, scope, and expectations of the project. Some of these activities are funded from external sources. During the first summer the supervisors are involved in over 100 hours of workshop experiences to enable them to prepare their own workshops for teachers in their districts. The participants are to establish a mathematics resource center and laboratory in each of the 52 elementary and junior high schools in which they will conduct inservice sessions that extend the workshop to other teachers at their schools. Also, there is a component involving parents as well as business and industrial leaders in the communities. The second and third summers of the project place emphasis on developing master teachers who are to serve as resource personnel at the targeted schools. The mathematics content of the courses is a blend between skill building and problem solving and covers the main topic areas in the school program. There are, for example, sessions underlying arithmetic topics as well as geometry and pre-algebra. The pedagogical component includes sessions on diagnosis, remediation, and methods of materials development. Follow-up activities during each of the intermediate years have the staff helping the leaders and master teachers conducting staff development sessions for other teachers in the districts. These activities take place primarily in the resource centers.

COLLEGE SCIENCE INSTRUMENTATION

John B. Garner	USE 8852861
Tougaloo College	FY88 $70,739
Tougaloo, MS	Computer Science

"Computer Science Curriculum Improvement"

This project supports curriculum enhancements in this institution's undergraduate Mathematics/ Computer Science program. With the equipment supported by this award, students in Computer Science are able to study advanced topics in Computer Science, to gain intuitive understanding of some mathematical principles through programming and to practice computing techniques. The laboratory equipment that supports this project includes: DEC VAX 8250, controller, DECNET and various compilers and other system and application software.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Dennis Strete TPE 8652323
Tougaloo College FY87 $111,315
Tougaloo, MS HS Science/Math

"Tougaloo College/Pre-College Teacher Development and Incentives"

Thirty high school science and/or mathematics teachers will participate in a three-week summer workshop and fourteen Saturday workshops during the academic year. The project focuses on updating knowledge in biology, physics, chemistry, mathematics, and computer science. The instructional phase of this project includes lectures, laboratory experiences, field trips, and special projects.

The participants will be chosen from 60 Mississippi counties, both rural and urban. The participants will provide local support from the school districts' administrations. The college will provide resource support for the implementation of the local inservice activities.

This project, with the support of local school systems, will aid significantly in helping the schools respond to the newly mandated science and mathematics requirements of the state department of education.

TEACHER ENHANCEMENT PROGRAM

John H. Bedenbaugh TPE 8751789
Angela O. Bedenbaugh FY88 $144,915
University of Southern Mississippi FY89 $314,428
Hattiesburg, MS FY90 $257,330
Chemistry

"Basic Chemistry for Inadequately Prepared High School Chemistry Teachers Through State-Wide Workshops"

Basic Chemistry for Inadequately Prepared High School Chemistry Teachers Through State-Wide Workshops will use a group of selected high school and college teachers of general chemistry to design a workshop program of instruction in basic chemistry for inadequately prepared high school chemistry teachers. During the first summer of operation (1988) a prototype workshop will be held at which the workshop curriculum will be class-tested and improved by the developers, who also will serve as the instructional staff. This six-week program then will be offered at five regional workshops at locations across Mississippi during the summer of 1989 (four of the workshops will be supported by NSF funds). At each workshop a team consisting of an experienced high school chemistry teacher and a college teacher will instruct 20 participants in basic chemistry and effective teaching methods. Laboratory teaching will be given special emphasis. During the following academic year, each participant will be visited in his or her school by a workshop staff member in an individualized follow-up activity. Group follow-up meetings also will be held during the academic year. Up to five more regional workshops will be offered during the summer of 1990 (three supported by NSF funds). The program has been developed under the auspices of the Mississippi section of the American Chemical Society with the cooperation of faculty from several Mississippi university and college campuses.

TEACHER ENHANCEMENT PROGRAM

Lawrence J. Bellipanni TPE 8751189
Fred W. Brown FY87 $104,577
University of Southern Mississippi JHS Science
Hattiesburg, MS

"Leadership Development, Content Enrichment, and Process Skill Development (LDCPS)"

Forty junior high school science teachers from eleven school districts will participate in a four-week workshop at the University of Southern Mississippi. Instruction on leadership development, content enrichment, and process skill development will be provided during the workshop. Field trips that will enhance the instructional program for students will be taken by the participants in the summer workshop. Materials development and evaluation of materials that are effective for classroom use will also be addressed during the workshop.

Each participant will conduct a minimum of two in-service workshops for other teachers in their local school districts during the academic year. A primary objective of this workshop is to involve the participants in meaningful activities which they can use in their classrooms rather than providing additional theory only. Provisions are made for school administrators to participate in these in-service activities that will be conducted by the teachers.

The participating schools districts and the university staff have made strong commitments to support the in-service phase of this project. Some districts are purchasing additional equipment while others are providing release time and other forms of support. The university staff will visit classrooms in each of the school districts and serve as a clearinghouse and resource center for the area.

TEACHER ENHANCEMENT PROGRAM

Nancy C. Dunigan TPE 8550167
University of Southern Mississippi FY85 $145,957
Hattiesburg, MS FY86 $137,804
FY87 $102,186
Mathematics

"Mathematics Refresher and Enrichment Through Applications Courses for Honors Teachers Project (M-REACH Teachers Project)"

This project will provide enhancement experiences for 30 selected Mississippi high school mathematics teachers through an intensive eight-week summer program at the University of Southern Mississippi.

Objectives of the M-REACH program are to improve the mathematical knowledge of participants with emphasis upon applied problem solving, to assist the teachers in creating classroom environments conducive to problematic teaching approaches, to recognize and honor top quality mathematics teachers, and to strengthen substantively the working relationships between university mathematicians and classroom teachers. The program of activities will include studies in three mathematics courses, guest speaker/capstone sessions, and mentor/tutorial/computer laboratory sessions. Teachers will collaborate on the production of a source book of applications of mathematics for use in their classrooms and in the conduct of inservice workshops in their school systems. Detailed planning and rehearsal for these inservice workshops will be completed to ensure the participants' readiness to work with their colleagues. During an autumn academic year weekend session, involving the school superintendent, each teacher will finalize plans and support for their inservice activities. In a spring session they will share experiences, evaluate the program, and plan for further activities.

TEACHER ENHANCEMENT PROGRAM

J.Emory Howell TPE 8751735
Lillie V. Tucker-Akin FY88 $173,476
University of Southern Mississippi FY89 $336,563
Hattiesburg, MS Chemistry

"Providing Discoveries in Chemistry for Elementary School Children"

Providing Discoveries in Chemistry for Elementary School Children is a three-year project of the University of Southern Mississippi which will provide 180 teachers of elementary students with preparation on how to use low-cost activities which develop an introduction to chemically related physical science concepts. Six-week summer sessions will be held for primary grades and for intermediate grades. A team that includes a master high-school chemistry teacher and an administrator will represent each of 18 participating school districts. They will be involved in the orientation, planning, implementation and follow-up evaluation phases of the project.

MISSOURI

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Nancy J. Crisler
Mathematics
St Charles West High School
Saint Charles, MO

Claudia K. Viehland
Science
Chaminade College Prep
St Louis, MO

1988

Jack McPike
Mathematics
Riverview Gardens Senior H S
Saint Louis, MO

Richard K. Kavanaugh
Science
Park Hill R-5
Kansas City, MO

COLLEGE SCIENCE INSTRUMENTATION

Gary D. Sells	USE 8851433
Northeast Missouri State University	FY88 $62,000
Kirksville, MO	Biology

"Laboratory Improvement for Cell Biology"

This project is providing instruments that improve five areas of a Cell Biology laboratory. An incubator and muffle furnace aid efforts to determine composition of cells. A photomicrographic microscope with capability to detect fluorescence is used to locate specific antigens by using FITC-antibodies. A cryostat is used to section fresh tissue that, selectively stained, is used to identify the cellular locations of specific molecules. Oxygen probes with accessories are used to follow electron flow rates in mitochondria and chloroplasts. A recording UV-VIS spectrophotometer enables undergraduates to do absorption spectra and to analyze enzyme reactions. Finally, electrophoresis chambers and a densitometer are used in the analysis of isozymes and the characterization of DNA.

The objective is to raise the level of involvement of sophomore Biology students in investigations of cell function. Early involvement of students in cell biology experiments is expected to result in higher scores on senior exams in the Cell Biology/Molecular section of the Graduate Record Examination.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Don E. Gibbs	USE 8852343
Rockhurst College	FY88 $25,850
Kansas City, MO	Chemistry

"Integration of Nuclear Magnetic Resonance (NMR) Spectroscopy Theory and Laboratory Applications in Undergraduate Chemistry Curriculum"

Nuclear Magnetic Resonance (NMR) spectroscopy is an indispensable source of chemical information. NMR studies provide much of the basis for theoretical concepts of molecular reactivity and architecture that are fundamental in undergraduate chemical education. Direct experience with NMR techniques helps students appreciate the basis of these concepts. NMR techniques are the most versatile of all modern instrumental methods. Because NMR instruments can be used in so many parts of the undergraduate Chemistry curriculum, students are aided in the important task of integrating what they learn in different courses. Students graduating in Chemistry, whether entering the job market or graduate school, are being significantly improved through the use of the NMR spectrometer. The NMR purchased allows for maximum information output in students' hands without undue diversion of faculty attention from the close individualized relation with students that is the pride of the Department.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Leonora G. Rueppel	USE 8852082
St Louis Community College Meramec	FY88 $26,350
Kirkwood, MO	Chemistry

"Introduction of Nuclear Magnetic Resonance (NMR) Spectroscopy to Undergraduate Laboratories"

The project is enhancing the course content in undergraduate organic chemistry laboratories by the addition of NMR to the Organic Chemistry laboratory. Implementation of this project involved the purchase of a Varian EM 360L 60 MHz Nuclear Magnetic Resonance Spectrometer (NMR). Students are having direct hands-on experience using this instrument and are acquiring skill in interpreting NMR spectra. After completing an experiment designed to introduce the techniques of NMR, students continue to use NMR in subsequent experiments to verify the structures of the products of synthetic reactions. Students are also using NMR to analyze product ratios in an experiment where a mixture of products is obtained. In addition, extensive use of NMR is being made during a unit on organic qualitative analysis. The addition of NMR to the Organic Chemistry laboratory course is giving students an understanding of this very important analytical technique which is now an essential feature of modern organic chemistry.

The grantee is matching the award from non-Federal sources.

INFORMAL SCIENCE EDUCATION

Jeffrey P. Bonner MDR 8651996
St Louis Science Center FY86 $274,098
Saint Louis, MO FY87 $ 27,119
Museums

"Development of Science Related Exhibits for Young Children"

The St. Louis Science Center is a major metropolitan science museum serving a population of 2.3 million people. One year ago they moved into a new facility at a new location and attendance at the museum has tripled, reaching 600,000 visitors this past year.

The center proposes to develop a "Science Playground" in order to teach basic science principles and process through a series of 45 participatory exhibitions around the major areas of motion, energy, light, sound and the natural environment. The physics of motion will be explored through exhibits such as a friction slide, lunar gravity swing, and double-axis human pendulum. Energy exhibits will provide experiences with watermills and water power, fulcrum leverage and solar energy. Light exploration includes a solar column, prisms and rainbows, soundwheel and whisper discs. A weather station will have a rain gauge, anemometer, and a variety of barometers.

The Museum surveyed 31 science centers, 82 parks and 85 school districts to gauge interest in this type of project. They found that there is a clear interest and demand by all sectors surveyed with the exception of rural parks. Designs of the exhibits will be published and furnished at cost to any facility wishing to replicate all or any part of the exhibition. This contemporary playground concept was developed, in part, as a response to limitations of indoor facilities and to extend use of outdoor space in a creative manner. The exhibit will be a model for schools, parks, other science museums and similar institutions to extend science learning. This project provides new and imaginative ways to extend science experiences.

This project is partially funded by the Division of International Programs.

COLLEGE SCIENCE INSTRUMENTATION

Walt W. Lilly USE 8750903
Southeast Missouri State Univ FY87 $23,855
Cape Girardeau, MO Biology

"Centrifugation Equipment to Enhance Undergraduate Education in Molecular Biology"

The modern methods of Molecular Biology have transformed the knowledge and skills expected of Biology majors. Unfortunately, the illustrative experiments required for effective transmission of the knowledge and acquisition of the skills are equipment-intensive and expensive.

The laboratory experiences of majors in Cellular and Molecular Biology are being modernized through the use of an ultracentrifuge and accessories purchased through this award. The ultracentrifuge is being used in laboratories in General Genetics, Molecular Genetics, Experimental Cell Biology, Immunology and Virology. Students are gaining hands-on experience with the instrument in a variety of laboratory situations including organelle and macromolecule isolation, plasmid isolation, and bacterial transformation by recombinant DNA methods. In addition, the instrument is being used to support independent studies by undergraduate students.

YOUNG SCHOLARS

Larry A. Lucas RCD 8850088
Southeast Missouri State Univ FY88 $22,848
Cape Girardeau, MO FY89 $22,848
Mathematics

"Young Scholars in Mathematical Sciences"

The Young Scholars in the Mathematical Sciences at Southeast Missouri State University is a program designed for 20 students (grades 9-12) who have completed at least one year of algebra. The three-week residential program focuses on a study of mathematics topics and on applications in physics. Computers are used in the mathematics problem solving process. A secondary focus of the program is an exploration of careers in the sciences and engineering. Field trips to a school of engineering and to major industrial sites allow participants to interact with scientists, engineers, and personnel directors in the workplace. One day is spent "shadowing" area scientists and engineers.

TEACHER ENHANCEMENT PROGRAM

Edward C. Stoever, Jr.	TPE 8470581
Ernest L. Kern	FY85 $475,043
Southeast Missouri State Univ	FY88 $ 10,263
Cape Girardeau, MO	Elem Sci/Math

"K-6 Science and Mathematics Improvement, Southeast Missouri"

K-6 Science and Mathematics Improvement, Southeast Missouri is a three-year collaborative project of Southeast Missouri State University, the Missouri State Board of Education, and local school districts to enable 2,040 elementary teachers to take a series of four short courses in science, mathematics and physical science at different elementary schools in 25 counties in southeast Missouri. The goals of this project are to develop:

1. a model program through which K-6 teachers can be encouraged and stimulated to introduce appropriate science and mathematics concepts into their classrooms;
2. a set of four K-6 resource guides which emphasize hands-on activities;
3. a cadre of 7 trained college teachers and 40 lead teachers who are adjunct faculty, qualified to conduct additional short courses;
4. to implement recommendations for a pre-service teacher training program in line with project objectives.

TEACHER ENHANCEMENT PROGRAM

Massoud M. Awad	TPE 8652317
Clyde A. Paul	FY87 $67,666
Southwest Missouri State Univ	Mathematics
Springfield, MO	

"Strategies for Problem Solving"

Mathematics faculty members at Southwest Missouri State University (SMSU) will conduct a four-week summer workshop in the teaching of problem solving, as applied to most scientific disciplines, for 30 junior high school teachers from southwest Missouri. Four key personnel, called "helping teachers," selected during the workshop, will receive additional leadership development and be actively involved in the further planning and implementation of this project. All participants will assist fellow teachers to implement strategies in problem solving throughout their curricula during the academic year.

Participants will construct lessons and teaching aids which demonstrate application problems in the fields of physics, astronomy, computer science, chemistry, biology, and/or geoscience. After implementing the problem-solving materials developed in the workshop and evaluating them, a monograph of the activities considered effective will be produced and distributed to each middle and junior high school principal in the 24-county service area of Southwest Missouri State University.

This project will become self-sufficient in 1988 when SMSU institutionalizes a course based on the workshop which will be made available and attractive to teachers under the State reimbursement law. The monograph and teacher developed materials will be available at the Problem Solving Materials Center at the University. A network of "helping teachers" and former participants will work together to conduct in-service workshops for fellow teachers.

"Strategies for Problem Solving" clearly and comprehensively addresses the dire need for more creative and innovative strategies for mathematical problem solving. It acknowledges and seeks to address science and mathematics instruction in rural, minority and economically disadvantaged school districts.

COLLEGE SCIENCE INSTRUMENTATION

Scott Carpenter	USE 8852040
Southwest Missouri State Univ	FY88 $72,422
Springfield, MO	Mechanical Eng

"Drafting Fundamentals - Micro-CAD Laboratory"

This project supports a state-of-the-art transition in industrial technology education. Using the equipment purchased through this award, students are able to gain expertise in Computer Aided Design and Drafting, migrating from the traditional two-dimensional paper and pencil environment to a three-dimensional dynamic environment. The primary equipment housed in the laboratory includes: Zenith CAD workstations with hard disks, co-processors, and CAD software. The workstations are networked, allowing design interaction and use of a digitizing tablet and printer/plotter.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

William T. Corcoran	USE 8750709
Southwest Missouri State Univ	FY87 $37,878
Springfield, MO	Geography

"Improving Undergraduate Cartography Education with Graphics and Data Base Systems"

Cartography, the art and science of map making is rapidly converting to computerized, digital data bases and highly interactive computer graphic displays. The Cartography and Map Technology Program is taking significant steps towards computerizing the map-making process taught to students. A mini-computer graphics system is being used in two separate ways: for teaching interactive map design; and in teaching data base concepts necessary in handling map data bases. The system includes graphics work stations with digitizers and controllers as well as a color hardcopy device to print the maps being produced. Since cartographic data represents some of the largest, most complex, and rapidly changing data bases, an advanced graphics computer system is helping students acquire the theoretical and practical knowledge necessary for dealing with mapping problems in the future.

COLLEGE SCIENCE INSTRUMENTATION

Christopher C. Field USE 8852048
Southwest Missouri State Univ FY88 $14,827
Springfield, MO Biology

"A Tabletop Ultracentrifuge for Teaching Undergraduate Cellular & Molecular Biology"

A curriculum in Cellular and Molecular Biology has been under development in the Biology Department for two years. The purpose is to provide a program which affords an option in Cellular and Molecular Biology to departmental majors, supports other intra- and inter- departmental programs, and provides a background for students interested in doing undergraduate research in these areas.

Recent developments include approval of an introductory course in Molecular Biology for sophomore students and the restructuring of existing courses. The tabletop ultracentrifuge provided through this award was needed to carry out laboratory exercises essential to the program, support student research projects and to provide practical experiences that reinforce pedagogical material covered in lectures. The tabletop model not only is suitable for all these uses, it also is less expensive to purchase and maintain, requires lower expenditures for materials, and is both easy and safe to use.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

David J. Hartmann USE 8852039
Southwest Missouri State Univ FY88 $12,576
Springfield, MO Sociology

"The Social Science Research Laboratory"

The Department of Sociology, Anthropology and Social Work has developed a social research curriculum and a Center for Social Research. The curriculum and Center provide opportunities for social science students to conduct field and laboratory research preparing them for careers as researchers, teachers and advisors and as scientifically literate citizens. The computers, printers and software funded by this award are used throughout the curriculum to foster methodological rigor and analyze real world data.

The award will be matched by an equal amount from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Vernon J. Thielmann USE 8750708
Southwest Missouri State Univ FY87 $50,000
Springfield, MO Chemistry

"Strengthening Undergraduate Organic and Analytical Chemistry--NMR"

As part of a three year departmental plan to improve undergraduate instruction, the Chemistry Department of Southwest Missouri State University has recently acquired a multinuclear, variable temperature 90MHz nuclear magnetic resonance spectrometer. This instrument is being used in courses in organic chemistry, organic qualitative analysis, physical chemistry, molecular spectroscopy, and biochemistry, with particular emphasis on it use in the interpretation of 13C NMR spectra. The availability of the new NMR system is also providing for additional undergraduate research projects in organic chemistry, biochemistry, polymer chemistry, analytical chemistry, and physical chemistry.

TEACHER ENHANCEMENT PROGRAM

Vernon J. Thielmann TPE 8751360
Southwest Missouri State Univ FY88 $107,210
Springfield, MO Chemistry

"Refresher and Enrichment Program for High School Chemistry Teachers of SW Missouri"

The purpose of this proposal is to strengthen the background and preparation of 25 to 35 high school chemistry teachers in southwest Missouri. The program will be carried out in two phases. Phase I will involve 25 secondary school teachers who are teaching high school chemistry, but who have only a chemistry minor or less of formal preparation. The program will involve an intense review of basic chemical principles, a considerable amount of time spent on problem solving, laboratory work involving experiments suitable for use in a high school laboratory, and laboratory demonstrations performed by the instructional staff, who will concurrently be encouraging participants in the development of their own demonstrations. The participants will work closely, both during the summer workshop and during the academic year, with a mentor who will be one of the area's strong high school chemistry teachers. The basic program will start with a three-week summer workshop, followed by four Saturday workshops during the school year.

Phase II will commence the next summer with the selection of 25 teachers, as many as 2/3 of whom will have been participants the previous summer. This phase is for teachers with a deeper background than Phase I teachers and will include more in-depth discussion of several theoretical topics, such as organic chemistry, biochemistry, environmental chemistry, and computer-aided instruction. Lecture, laboratory, problem-solving, and demonstration sessions will again be scheduled for this group of teachers.

It is expected that about thirty-five different teachers will be involved in the program in one or more of the two phases. Evaluation will be carried out by pre- and post-testing the participants and their students and by the observations of the mentor teachers and University personnel during their classroom visits. Letters were received from the high schools being served supporting inservice time to implement and encourage changes in the teaching of chemistry.

COLLEGE SCIENCE INSTRUMENTATION

James D. Hoerter	USE 8851225
Stephens College	FY88 $15,000
Columbia, MO	Biology

"Instrumentation to Support Student Research in Molecular Biology by Undergraduate Women"

The objectives of the molecular biology research laboratory for undergraduate women in science are:

(1) to establish a state-of-the- art research laboratory in molecular biology to prepare women for biomedical careers and/or graduate research;

(2) to strengthen the College's existing research internship program by establishing an on- campus lab equipped to permit more sophisticated student research and independent study; and

(3) to foster a "partners in scholarship" atmosphere for faculty and students in the Biology Department.

The acquisition of the electrophoresis apparatus, centrifuges, a spectrophotometer, and support instrumentation (incubators, sterilizer, orbital shaker) are modernizing the laboratory for student research in molecular biology. This lab enables students to learn the latest techniques employed in studying the molecular biology of proteins and nucleic acids, and then permits them to apply these techniques by designing and carrying out an independent research project. Research projects culminate in a seminar presented to the Missouri Academy of Science and a research manuscript. Some of the latter have proved to be suitable for publication.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

RESEARCH IN TEACHING AND LEARNING

Thomas L. Good	MDR 8550619
Douglas A. Grouws	FY86 $157,948
University of Missouri	FY87 $173,349
Columbia, MO	FY88 $ 46,577
	Mathematics

"Small-Group Instruction in Mathematics: Naturalistic Research in Teaching and Learning"

This systematic research project of classroom teaching and learning of mathematics in grades 3 through 6 is intended to : (1) describe teachers' beliefs about small-group mathematics instruction with a particular interest in specifying mathematical content that is especially appropriate for small-group instruction; (2) identify instructional strategies teachers use during small-group instruction; (3) replicate those instructional strategies in different educational contexts; (4) examine small-group instruction in the areas of problem solving, estimation, and measurement (by making videotapes of these lessons and coding classroom behavior); (5) examine the correlation between different small-group instructional strategies and students' mathematics performance; (6) with the assistance of the National Advisory Board, develop at least two innovative treatments for improving the effectiveness of small-group mathematics instruction; and (7) disseminate the results of the project in a monograph discussing research findings and concepts and in a videotape(s) that will illustrate effective practices.

TEACHER ENHANCEMENT PROGRAM

Gary W. Nahrstedt	TPE 8550892
Larry E. DeBuhr	FY86 $78,994
University of Missouri Kansas City	FY88 $83,152
Kansas City, MO	Elem Science

"Metropolitan Kansas City/Elementary Science Specialist"

Metropolitan Kansas City/Elementary Science Specialist is a three-year professional development project for 90 well-prepared teachers in 12 cooperating school districts in the Kansas City metropolitan area. Activities include a one-day workshop for principals, supervised internships in schools, and inservice activities conducted by 30 of the participants each year after an eight-week, nine-credit, summer course at the University of Missouri-Kansas City. Course content which focuses on major conceptual themes in the physical, life, and earth sciences was developed by the project staff and participants.

The program involves considerable support, planning, and cost-sharing from the cooperating school districts, as well as collaboration with a variety of community institutions including the Kansas City Zoo, the National Energy Foundation, and the Science Pioneers. This model for teacher enhancement is being evaluated as a prototype for the development of more appropriate approaches to the science preparation of preservice elementary teachers at the University of Missouri-Kansas City.

COLLEGE SCIENCE INSTRUMENTATION

Paul R. Munger	TPE 8722130
Carol A. Smith	FY88 $31,800
University of Missouri Rolla	Engineering
Rolla, MO	

"Engineering Ethics Training Seminar"

The 1970s saw the first sustained and systematic studies of engineering ethics in the U.S., the first efforts to encourage engineers to collaborate with scholars from the social sciences and humanities in such studies, and the first efforts to educate engineering students about ethical issues. This project will break new ground by planning and developing an Engineering Ethics Training Seminar. Faculty from the humanities and engineering will develop a two-day seminar designed to introduce engineers to moral reasoning, moral theories and concepts, and alternative models of professional responsibility of engineers. The seminar will be tested with four groups of practicing engineers in Missouri. It will continue to be offered after the project period, and a plan for identifying and involving national societies in undertaking similar programs for their members will be developed.

Project faculty will develop and distribute seminar materials to participants prior to the seminar. The first day will concentrate on moral theories and their application to case studies; the second day will discuss models of engineering responsibility and their application to a major case. Pre-seminar and seminar materials will be packaged and distributed to teachers and researchers in engineering ethics.

This project provides a model for future efforts in ethics education for engineers. Results are likely to be widely distributed and advance the field substantially. The investigators are extremely well qualified; institutional support and cost-sharing are excellent.

This project is co-funded with the NSF Directorate of Biological and Behavioral Sciences.

CAREER ACCESS OPPORTUNITIES

Charles R. Granger	USE 8850625
University of Missouri St Louis	FY89 $106,919
Saint Louis, MO	FY89 $100,000
	Other NEC

"St. Louis Regional Science-Technical Career Access Center for Minorities"

This prototype project includes several activities to strengthen minority education from the early grades through the baccalaureate degree. It was developed under the leadership of the University of St. Louis-Missouri, with cooperation from Harris-Stowe State College, St. Louis Community College, and the St. Louis School System. During the first year of operations a set of activities, based on science and mathematics experiences, and designed to nurture, encourage and motivate minority students, are being implemented. These include a College Transition program in which pre-freshman students are provided with experiences in academic skills development, remedial mathematics, career related work activities, and assistance in college planning. Activities targeted at the precollege level include junior high school science and engineering clubs which meet for field trips during the academic year and for a four-week workshop during the summer. A high school Science and Math Academy meets for five weeks in the summer at which academic courses in science and mathematics, tutoring, career counseling and college planning are made available.

TEACHER ENHANCEMENT PROGRAM

Deborah T. Haimo	TPE 8751819
Richard J. Friedlander	FY88 $268,570
University of Missouri St Louis	Mathematics
Saint Louis, MO	

"Raising Awareness of High School Teachers of the Breadth of Applications of Mathematics"

The project will involve 90 high school mathematics teachers, 30 each year over a period of three years, with inservice opportunities to update their knowledge of topics in discrete and continuous mathematics. There is to be an intensive summer course in applications provided by the project staff and enriched by visitors from diverse occupations. The participants are to prepare papers on applications of mathematics that they have studied and about which they will teach to their students. The participants will prepare multiple copies of their applied lessons for distribution to the other participants and other interested parties. There is to be a demonstration class for participants which involves staff from the project working with teachers in their own classrooms. Also, there will be presentations by the participants for their peers dealing with issues from the main topics of interest.

Developing out of the project will be a network of teachers who encourage the sharing of information about the applications of mathematics with other teachers in the network. One of the principle investigators will conduct an extensive program of classroom visitations to provide support to the participants during the school year. There will be a hot line available from the teachers directly to the PI for help or information dissemination. Videotapes of highlights of various presentations by project staff, scientific visitors, and participants will be disseminated. There is the intent to establish a resource center for offering the participants a broad range of materials on applications of mathematics and to provide extensive references. The participants are to be selected from among those recommended by the school districts that are committed to the project.

MONTANA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Gil Alexander
Science
Helena High School
Helena, MT

Sue Dolezal
Mathematics
Sentinel High School
Missoula, MT

1988

Kimberley Girard
Mathematics
Nashua Public School
Nashua, MT

Glenn Govertsen
Science
Sentinel High School
Missoula, MT

COLLEGE SCIENCE INSTRUMENTATION

S. Valentine	USE 8853146
Dull Knife Memorial College	FY88 $45,974
Lame Deer, MT	Computer Science

"Technical Graphics Laboratory"

This project permits this institution to offer a degree program in technical graphics, one that includes graphical representation for industry as well as CAD/CAM applications. The equipment that supports the project includes twelve (12) Macintosh II microcomputers and associated hardware and software to permit students to learn graphical concepts in a project-oriented studio environment.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Judith A. McLaughlin	USE 8750882
Eastern Montana College	FY87 $13,609
Billings, MT	Psychology

"The Use of Microcomputers to Substitute for and Supplement Traditional Laboratory Equipment in Psychology"

The Department of Psychology attempts to provide its students with a rigorous, scientifically-based education in Psychology. With the limited resources available to a small school and Montana's current budgetary crisis, providing and maintaining the laboratory equipment necessary for a quality education is becoming increasingly difficult. The project will use computer-simulated laboratory exercises to supplement and substitute for the use of expensive standard laboratory equipment to provide a relatively inexpensive solution to this problem, at the same time providing students with pedagogically-sound laboratory experiences. Microcomputers can combine the functions of numerous pieces of standard laboratory equipment. Software is available and will be written to provide students with experience with a broad range of psychological concepts and experiments.

COLLEGE SCIENCE INSTRUMENTATION

Karl E. Burgher	USE 8750031
Montana College of Mineral Science and Technology	FY87 $14,499
Butte, MT	Metals Eng

"An Undergraduate Rock Fragmentation Laboratory for Mining Geophysical Engineers"

A rock fragmentation and blasting laboratory will be installed at a local open pit mine for undergraduate mining and geophysical engineering students. Using a digital seismograph system, the students will enhance their understanding of blast design and the environmental effects of blasting, ground vibration and airblast control. The students will also gain experience in seismic exploration and the interpretation of three dimensional seismometry.

COLLEGE SCIENCE INSTRUMENTATION

Thomas E. Finch	USE 8851803
Montana College of Mineral Science and Technology	FY88 $48,330
Butte, MT	Civil Eng

"Surveying Laboratory Enhancement"

This project introduces students in this institution's mining program to state-of-the-art surveying practices. By exposing students to Total Surveying Stations, not only is their surveying experience enhanced, experiments are performed that were not possible before the advent of equipment of the type used in this project. In their field work, students get hands-on experience and retrieve digital data with portable devices. In their laboratory work, students have a collection of software tools whereby they analyze their field data and use graphical programs to display and manipulate collections of their field data.

This award is being matched by an equal sum from the grantee.

PRIVATE SECTOR PARTNERSHIPS

Nina A. Klein	TPE 8851070
Ginger Toivonen	FY88 $162,712
Montana College of Mineral Science and Technology	MidSch Sci/Math
Butte, MT	

"Project PARTNERS"

Project Partners will provide a coordinated series of programs and resources to enhance the capabilities of middle school science and mathematics teachers, many of whom have only General Teaching Certification, in predominantly rural southwestern Montana. Mining industry (the predominant local industry) and college science, engineering, and mathematics professionals will jointly develop and present a series of academic-year and summer workshops and support teachers in the development of locally-oriented teaching materials. A resource center will be created containing teaching materials which can be utilized by all the teachers. An objective will be the establishment of a continuing, locally-supported networking procedure for these teachers.

Cost sharing by the schools, colleges, and industry will total 34% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

John L. Sonderegger	USE 8852350
Montana College of Mineral Science and Technology	FY88 $41,610
Butte, MT	Geology

"Field Equipment for Undergraduate Hydrogeological Program"

This college will purchase a data logger, six water level recorders and logger, a well monitoring system, a water quality monitor, a ground water flow meter, eight conductivity meters, a generator, a stratigraphic gamma probe, a normal resistivity probe, two wellhead temperature probes, a permeameter, two air-lift samplers, a gas chromatograph and an organic vapor detector. This equipment will be used to improve instruction in a summer field course in Hydrogeology. Students will receive "hands-on" training in well construction, aquifer testing, well development, and water quality monitoring.

The grantee will match the NSF award with an equal amount of funds, and also will provide funds for well drilling and construction.

TEACHER PREPARATION PROGRAM

Daniel T. Dolan	TPE 8470543
Montana Council of Teachers of Mathematics	FY85 $174,338 FY86 $292,348
Billings, MT	FY87 $193,732
	Mathematics

"Excellence for Montana Mathematics Education"

This project is developing a model program for the in-service education of elementary school teachers for large geographic regions with sparse populations. The project is a comprehensive statewide program to assist local school districts in Montana in providing high quality continuing education opportunities in mathematics for elementary teachers.

During the project, six-week sessions are being held each summer at the University of Montana and at Montana State University for the purpose of preparing carefully selected teachers from grades K-8 to become regional mathematics in-service leaders. The complete program takes two summers, and the first session was held in summer, 1986. Following that session the regional mathematics leaders have presented in-service workshops in districts throughout the state. The workshops will be planned and presented with the cooperation of the university faculty who taught the training sessions.

TEACHER ENHANCEMENT PROGRAM

Robert D. Briggs	TPE 8652455
Montana Science Teachers Association	FY87 $474,531
Helena, MT	Elem Science

"Better Elementary Science Teaching (BEST)"

Better Elementary Science Teaching (BEST) will prepare fifty Montana K-6 teachers per year, for three years, to become Science Advocates. The Science Advocates' responsibility will be to evaluate local inservice needs and to design an inservice response to those needs. Montana requires each school to have an inservice planning committee and the Science Advocates will be members of these committees. The actual delivery of inservice instruction will come from the state's scientific community. The various partners will both identify and supply the necessary scientific personnel. During the summer of 1987, the first four-week BEST Institute will be held at Eastern Montana College in Billings, the second institute will be held at Montana State University in Bozeman in the summer of 1988, and at the University of Montana in Missoula in 1989. The course work of the summer institutes will consist of an intensive program to update and upgrade science content material. In addition the Science Advocates will develop management techniques and learn the appropriate materials for use with science series as well as individually developed curricula.

Several post-institute activities are in place to stimulate information dissemination and the sharing of ideas. The project allows for the following three methods of long-term follow-up:

1) The Electtronic Communication Network is an electronic telecommunications bulletin board which will be available 24 hours a day for private or public information exchange for the Science Advocates;

2) The Advocate/Faculty Field Support Program will consist of the project faculty conducting monthly sessions with Science Advocates, using audio-conferencing with small groups or individuals, and on-site visits when appropriate; and

3) Follow-up Conferences. Advocates from the first two years will participate in a conference the day prior to and the first two days of the second and third summer institutes, during which they will participate in the Science/Technology/Society segment of the institute. Third-year Advocates will participate in a special Thomas Alva Edison Institute which will serve as the final S/T/S session for all Advocates.

YOUNG SCHOLARS

Gerald F. Wheeler	RCD 8850160
Kimberly O. Nelson	FY88 $40,137
Montana State University	FY89 $40,137
Bozeman, MT	Engineering

"A Rural Model for Connecting Young Scholars"

This project brings fifteen 8th and 9th grade students to Montana State University for science-related career exploration activities. The project begins with a 9-day residential summer workshop of lab and field experiences. It is followed by a structured computer-network set of activities designed to connect students in their local setting with each other as well as university personnel. Two academic-year meetings expose students to established science programs for high-achieving students in the state.

COLLEGE SCIENCE INSTRUMENTATION

Lonnie J. Guralnick	USE 8851150
Rocky Mountain College	FY88 $15,500
Billings, MT	Biology

"Equipment to Improve the Undergraduate Biochemistry Laboratory Program"

The goal of this project is to provide equipment to support the initiation of a biochemistry laboratory and senior-year research programs. The equipment is for centrifugation, spectrophotometry, and potentiometric techniques.

The Biology Department is revising its curriculum in order to offer a greater focus on the health sciences. The restructuring already has doubled departmental enrollments. The new equipment is helping to produce graduates who are better prepared for advanced study and better able to serve the community at large.

The grantee institution is matching the NSF award with funds obtained from non-Federal sources.

FACULTY ENHANCEMENT PROGRAM

Robert W. McKelvey	USE 8854199
University of Montana	FY88 $97,917
Missoula, MT	Ecology

"Workshop on Modeling Methods in Biological Resource Conservation"

This is a workshop on the use of mathematical and computer models in biological resource conservation. It is designed to bring together an interdisciplinary group of college teachers in ecology and population biology, biological resource management, and applied mathematics. The purpose of the workshop is to involve the participants in the techniques of biological modeling, to enhance their effectiveness in presenting modeling methods in the classroom, and to encourage the use of interdisciplinary modeling approaches to broad scientific questions.

About 25 college and university faculty will participate in two sessions. The main four-week session will be held in August, 1988, with a one week follow-up session the following June. During the intervening academic year each participant will undertake an individual project at his or her home institution, and these will be reported on and discussed in the follow-up.

In the main four-week session, participants will be introduced to some of the principal issues of conservation biology, and to modeling techniques for their analysis. The session will culminate in a group modeling project, analyzing the conservation biology of the Black-Footed Ferret.

In addition to the NSF funds, participants' institutions will contribute about 15% in travel costs to the operation of the project.

NEBRASKA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Mary A. Kubovy
Science
Benson High School
Omaha, NE

Karen S. Ward
Mathematics
Lincoln Southeast High School
Lincoln, NE

1988

Richard Simon
Mathematics
Northwest High School
Omaha, NE

James E. McGahan
Science
Northwest High School
Grand Island, NE

COLLEGE SCIENCE INSTRUMENTATION

Jerome J. King	USE 8750201
College of St Mary	FY87 $7,193
Omaha, NE	Biology

"Computerization of the Introductory Physiology Laboratory"

Computer-based technology in areas of data collection, storage, retrieval, display, manipulation, and interpretation is growing rapidly. Use of such technology provides an excellent learning environment/program in an introductory Human Physiology laboratory. For some years, students have collected and interpreted data related to physiological concepts by using transducers, monitors and bioamplifiers. By combining an IBM XT computer and Coulbourn's physiology research system, students now are able to store the data and to develop simulations based upon them. Use of such models permits them for example, to observe the effects of an experimental intervention without actually putting the subject at risk. The system is bridging concepts in physiology and computer information management, allowing students to further advance their science education as well as to develop their skills with computer applications.

COLLEGE SCIENCE INSTRUMENTATION

David H. Smith	USE 8851378
Doane College	FY88 $5,880
Crete, NE	Chemistry

"Modernization of the Spectrophotometric Capabilities of Doane College"

Upperclassmen in the sciences need to spend both lecture and laboratory time learning how new information is obtained and how to design and interpret experiments. The laboratory must provide them with experience in as many major techniques as possible, performed with modern instruments. The college is purchasing a modern ultraviolet-visible spectrophotometer with computerized data treatment capabilities. This versatile instrument is being used to perform kinetics and thermodynamics experiments, determine the concentrations of a wide variety of solutions, record spectra, and manipulate the resulting data. The instrument is being used in courses in Instrumental Analysis, Physical Chemistry, Biochemistry, Organic Chemistry, Genetics, and Cell Biology. In each course, students are learning to solve at least one laboratory problem and to use the techniques to solve other problems they will face in graduate school and on the job.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

William J. Wozniak	USE 8852068
Kearney State College	FY88 $11,312
Kearney, NE	Psychology

"Computer Laboratory in Human Experimental Psychology"

The Psychology Department curricula are advanced by the establishment of a computer laboratory in human experimental psychology. A network of personal computers is used in teaching the research process and in the application of the research process in laboratory courses. The beneficiaries of the proposal are: (a) traditional Psychology majors, who are required to participate in a three or four semester sequence of research courses, and (b) Human Factors and Psychobiology majors, who have special requirements in research. The proposal has direct impact on these students through the following courses: Research Methods, Experimental Psychology, Human Learning and Memory, Sensation and Perception, Physiological Psychology, Experimental Lifespan Psychology, and Human Cognition.

The award will be matched by an equal amount from the grantee.

INFORMAL SCIENCE EDUCATION

Twila C. Liggett	MDR 8751433
Jack G. McBride	FY87 $250,000
Stephen C. Lenzen	FY88 $250,000
Nebraskans for Public Television Inc	FY89 $250,000
Lincoln, NE	Broadcasting

"Reading Rainbow"

READING RAINBOW is a multi-part PBS children's television series that encourages children ages five through nine to read good books. The program format involves book reviews through narration and illustration with an overall program theme set by a lead book. With support from NSF they have produced and aired five half-hour programs devoted to science books and science topics as part of the READING RAINBOW series. The present proposal will add an additional eight programs that focus on scientific themes over the next four seasons of the program, demonstrating to children how science is integrated into all aspects of their lives and encouraging them to read science books.

The series utilizes a thorough system of book and program topic review before material is selected for each program. Scientists, educators, librarians, teachers, parents, and children evaluate candidate books for interest, appropriateness, readability, and suitability for television treatment. READING RAINBOW programs are evaluated for effectiveness after they are produced to provide feedback for future programs.

The resulting programs are having a substantial effect on home, school, and library. Booksellers are reporting dramatic increases in sales of reviewed books; librarians greatly increased requests for and use of materials. Recent READING RAINBOW book reviews have led to new covers and new marketing programs for books, and teachers are using materials during the school year following summer broadcast. Publishers, seeing an increased market for books for young children, are encouraging new work by authors and illustrators.

TEACHER ENHANCEMENT PROGRAM

Donald W. Miller	TPE 8550604
University of Nebraska	FY86 $239,135
Lincoln, NE	FY87 $268,982
	FY88 $249,976
	Mathematics

"Nebraska Mathematics Scholars Program for Secondary School Teachers"

This project provides enhancement and professional development experiences for 60 exemplary secondary school mathematics teachers from Nebraska. The goal of the project involves: 1) the updating and deepening of the participants' mathematics backgrounds and teaching methodologies, 2) the networking of the participant Fellows, who are six outstanding secondary mathematics teachers selected to be part of the project staff as Senior Fellows and six university and college mathematics faculty, 3) the conduct of problem-solving lessons in participants' classrooms, 4) the conduct of at least four all-day in- service workshops by the participants for their colleagues in their home schools, 5) appropriate recognition for honors teacher participants, 6) the dissemination of the project methods, materials, and results to nearby school systems and rural states, and 7) a carefully planned documentation, assessment and evaluation effort.

Two Senior Fellows and two professors will study together at each of three sites (UN-Lincoln, Chadron State College, and Hastings College), all completing a similar program of professional development after three years which will include 6 graduate mathematics courses, 3 computer seminars and 3 dissemination seminars (24 graduate credits from UN-Lincoln). The participants will complete a five-week residential workshop each summer, rotating as a group to a different campus each summer. Participants will be visited and observed in their classrooms and in their workshops with their peers, and each will prepare a videotaped session to be shared with project staff and participants. Careful documentation and analysis of these observations and of teacher reports will provide a significant basis for a detailed project evaluation, both by project staff and expert external evaluators.

COLLEGE SCIENCE INSTRUMENTATION

James P. Hagen USE 8851356
University of Nebraska at Omaha FY88 $62,365
Omaha, NE Chemistry

"Nuclear Magnetic Resonance (NMR) Spectroscopy Across the Curriculum"

A Varian Gemini-200 Nuclear Magnetic Resonance (NMR) spectrometer is allowing more emphasis on the use of carbon NMR in the sophomore organic laboratory, introducing NMR kinetic experiments into the physical chemistry laboratory, and expanding the educational impact of the Instrumental Analysis and Spectroscopy courses. In addition, undergraduate student research is being significantly improved. The American Chemical Society's Committee on Professional Training has emphasized the importance of introducing the students to modern instrumentation and the challenge of research as early as possible in their studies in order to attract students to Chemistry and to better prepare them for a career in the Chemical Sciences. The superconducting NMR is adding a new dimension to and injecting excitement into the program.

The grantee is matching the award from non-Federal sources.

NEVADA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Bobbie S. Poole
Mathematics
South Nevada Vocational Tech Center
Las Vegas, NV

Andree P. Reed
Science
Chaparral High School
Las Vegas, NV

1988

Diana L. Perkins
Mathematics
Moapa Valley Jr/Sr High School
Overton, NV

James Bryn
Science
Sparks High School
Sparks, NV

NEW HAMPSHIRE

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Judith A. Mulvey
Mathematics
Spaulding High School
Rochester, NH

Terry Thompson
Science
Richmond Middle School
Hanover, NH

1988

Susan V. Janosz
Mathematics
Manchester High School West
Manchester, NH

Maurice Belanger
Science
Nashua High School
Nashua, NH

COURSE AND CURRICULUM

Richard H. Crowell	USE 8814009
Dartmouth College	FY88 $50,464
Hanover, NH	Mathematics

"Calculus: Restructuring and Integration with Computing"

Mathematicians of Dartmouth College will integrate computers into and plan the restructuring of the Calculus curriculum.

Their approach will emphasize elementary functions and use the computer for graphical displays and computation of tables of function values. Student written programs will be used to investigate these functions. Differentiation and integration will be taught by means of the difference calculus, making heavy use of the computer. These concepts will be used to solve "real- world" problems.

It is expected that students will gain a deeper understanding of calculus concepts from the combination of theory, applications and computer investigations. During the four course calculus sequence, students will develop the capabilities of doing their own numerical and graphical investigations independently.

Dartmouth will develop text and computer materials, demonstration programs and problems. Plans for the testing and evaluation of this new curriculum will be made during the planning grant.

Dartmouth is financing one-third of the project.

COLLEGE SCIENCE INSTRUMENTATION

William D. Totherow	USE 8851931
Rivier College	FY88 $23,584
Nashua, NH	Chemistry

"Incorporation of Fourier Transform Infrared Spectroscopy into the Undergraduate Chemistry Curriculum"

A computer-controlled, Fourier Transform Infrared (FT-IR) spectrophotometer is being incorporated into a project-based laboratory curriculum at this women's college. This laboratory program, developed over many years, involves students early with problem-solving and chemical instrumentation. The small classes permit introducing freshmen to basic spectral techniques and the FT-IR, in its one-button mode, is exposing these students to this powerful technology. Involvement with instrumentation is expanded through Organic Chemistry, Quantitative Analysis and an advanced lab in the junior year. The FT-IR is being used extensively in Physical Chemistry for kinetics experiments and to obtain high resolution spectra of gases. The FT-IR is greatly enhancing current experiments and numerous experiences, not previously possible, are becoming routine, including computer data handling, spectral database searches, and reflectance sampling methods. Exposing students to the FT-IR at progressively higher levels is allowing them to use all of its capabilities.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Daniel J. Lavoie	USE 8750891
Saint Anselm College	FY87 $17,632
Manchester, NH	Biology

"The Research Commons Approach to Teaching General Biological Research Processes"

The special characteristic of this project is its plan for creating a "research commons" for undergraduate science majors. A student research and study suite surrounded by faculty offices has been established and equipped to support a curriculum that places major emphasis upon students' learning through research participation. Basic scientific skills in research are being developed by underclassmen through regular use of microscopes, spectrophotometers, and related equipment. By requiring all Biology, Natural Science, and Biochemistry seniors to participate in student research, graduates leave the program with ability to design, plan, and execute experiments, to critically evaluate experimental results, and to design new experiments based on such evaluations. The students also are developing skills in reporting and communicating ideas and experimental findings in both informal and formal presentations.

The new equipment is aimed at meeting the needs of the students for experience in conducting research under faculty direction. The physical reorganization of the Department is complete, the faculty all are actively directing student research, and now the equipment needs are being met. This places the Department in a strong position to accomplish its goal of developing problem-solving capabilities in its majors, not just providing them with an accumulation of biological facts.

COLLEGE SCIENCE INSTRUMENTATION

Lowell A. Roberts	USE 8852967
Gary Bonitatibus	FY88 $18,502
Saint Anselm College	Psychology
Manchester, NH	

"Instrumentation for Instruction and Research in Psychophysiology"

This project updates the curriculum in Psychology involving computer applications linked to scientific equipment. It serves instructional and research needs of the Psychology Department. The new equipment replaces outdated and non-operational existing equipment. It enables classroom instruction and student research in Psychophysiology, with the new four-channel recorder of psychophysiological data. Undergraduate education is further enhanced by incorporating the application of computer technology with modern psychophysiological recording techniques.

The award will be matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Joan F. Ferrini-Mundy	TPE 8550191
University of New Hampshire Durham	FY85 $ 71,049
Durham, NH	FY87 $152,031
	FY88 $153,550
	Mathematics

"Honor Program and Regional Teacher Development in Mathematics and Science"

This project will provide enhancement and professional development experiences for 16 certified and 40 uncertified New Hampshire secondary mathematics and science teachers. The overall goals of the multi-year project involve the updating and deepening of conceptual understanding and pedagogical competence of both groups of teachers. Based upon a careful analysis and rationale of significant activities for helping teachers to improve their teaching, the project represents a scholarly yet practical approach to building, evaluating, refining and documenting a model for the continuing education of teachers. Excellent cooperation among schools, state, and university exist, evidenced by considerable cost-sharing for this project.

Eight mathematics, 3 physics, 3 chemistry, and 2 earth science "teacher specialists" (TS's) will be selected to participate throughout the three-year project. These 16 teachers will engage in an intensive 4-week seminar on the university campus, working with four scientists and mathematicians, to update and deepen their perspectives on their fields. In addition to other activities, they will collaborate on the preparation of 8 mini-courses which they will conduct in 20 locations throughout the state during the academic year follow-up.

During the second and third years, 40 uncertified "conversion teachers" (CT's) will be selected to participate, including 20 mathematics, 7 physics, 7 chemistry, and 6 earth science teachers. They must first complete at least 2 of the mini-courses presented during the year by the TS's. During the subsequent summer the CT's will complete modularized courses team-taught by project scientists and the TS's. They will study fundamental concepts and processes, including thorough attention to problem solving, appropriate to teaching secondary subject matter. The returning TS's will also develop and refine the academic year workshops. Teams of TS's and CT's will conceptualize and plan enrichment programs to be conducted at the end of the summer for 10-20 high school students in "local academies." In these contexts the CT's will have opportunities to practice and apply their new knowledge under the guidance of their colleague TS's. Detailed assessments will be made to obtain longitudinal indicators of teacher growth, including frequent observations and interviews of participants and their students. Quality course materials for this teacher education model will also be produced and made available to other sites.

COURSE AND CURRICULUM

Joan Ferrini-Mundy	USE 8814057
Donovan H. Van Osdol	FY88 $40,487
Lee L. Zia	Mathematics
Karen Geuther	
Eric A. Nordgren	
University of New Hampshire Durham	
Durham, NH	

"From Euclid to von Neumann, an Activity-Based Learning Experience in Calculus: Project ENABLE"

In this one year planning grant, mathematicians, mathematics educators, engineers and scientists of the University of New Hampshire (UNH) with high school teachers and Technical Education Research Center will develop and refine mathematical, educational and technological perspectives for a three semester calculus curriculum.

The project will first conduct a baseline assessment of first semester calculus students at UNH and high schools, to determine their algebra and trigonometry skills, as well as their understanding of essential precalculus concepts. Implementation of the reorganized and streamlined curriculum requires a clear perception of the students' knowledge base and misconceptions, as well as the students active participation in their own learning.

The curriculum will start with the concept of approximation, whose idealization will lead to derivatives, integrals and continuity. Biweekly seminars to develop prototype materials, outline modules and core units will be held during the academic year. Some components will be tested in high schools during the spring semester, and at UNH in the summer of 1989.

UNH is providing almost 55% of the project's costs.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

YOUNG SCHOLARS

William E. Geeslin	RCD 8850274
B.Sharon Meeker	FY88 $30,936
University of New Hampshire Durham	FY89 $30,936
Durham, NH	Mathematics

"UNH Mathematics and Marine Science Program"

The University of New Hampshire Mathematics and Marine Science Program (UNH M&M Program) is an integrated approach to introduce participants to scientific studies and careers. This is a three-week summer program consisting of the study of marine science, probability, statistics, computer analysis of data, and scientific methodology. Twenty tenth-grade students receive classroom instruction in the above areas, and participate in four field trips revolving around the study of coastal issues and environments. The UNH Sea Grant Program has access to several wildlife areas including an offshore island laboratory. Field trips are conducted to Great Bay, Appledore Island, Odiorne Point, Portsmouth Harbor, and local salt marshes. All instruction is provided in a team-teaching format.

NEW JERSEY

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

James H. Blake
Mathematics
Newark Academy
Livingston, NJ

Alan L. Schwartz
Science
Holmdel High School
Holmdel, NJ

1988

Robert E. Johnson
Mathematics
West Morris Central High School
Chester, NJ

Erik A. Mollenhauer
Science
West Deptford High School
Westville, NJ

COLLEGE SCIENCE INSTRUMENTATION

Alice A. Sayler	USE 8852475
Bloomfield College	FY88 $18,213
Bloomfield, NJ	Electrical Eng

"Laboratory for Applied Scientific Computing"

This data acquisition and analysis laboratory supports a unique applied scientific computing program at this institution. Students in this program study digital electronics, interfacing, science applications and carry on individual computing projects. In their courses, they gain experience in using off-the-shelf interfacing equipment and software and develop their own versions for data acquisition and instrument control. Because of its simplicity, this lab is also used by other science majors at this institution.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Kamal Sinha USE 8852285
Cumberland County College FY88 $97,095
Vineland, NJ Chemistry

"Plastics Processing Laboratory for Undergraduate Instruction "

Cumberland County has traditionally been the center for glass manufacturing in New Jersey. Almost 60 percent of the local economy was directly and indirectly related to the glass industry. In recent years a variety of factors, including high energy costs, foreign competition, consumer acceptance of plastic, have contributed to a sharp decline in this sector of the County's economy. Plant closings and large scale layoffs raised the local unemployment rate in 1984-85 to 18 percent. Cumberland County is consistently ranked as one of the top 10 unemployment areas in the country. Plastics manufacturing has begun to become an important aspect of the regional manufacturing base. Since a 1983 report on the industry was prepared by the New Jersey Department of Commerce and Economic Development, the number of plastic manufacturers in Cumberland County has doubled and the work force has increased by 53 percent. As the number of plastics manufacturers increase, the need for a skilled work force also increases. To meet this need the College has established a laboratory facility to support the offering of a new course, Processing of Plastics. This course is a core requirement in a new program for a Plastics Processing Technician Certificate Program which is serving both undergraduate students who will transfer and those who are working in the local area. The laboratory facility is giving the students hands-on experience in understanding the principles of processing plastics on machinery and test apparatus; in the melt flow characteristics of typical resins in extrusion, injection molding, and compression molding; and in the testing of melt flow and physical properties of plastics in accord with commercial methods of characterization and assurance for the use in production.

The grantee is matching the award from non-Federal sources.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Edward A. Chittenden MDR 847199
Educational Testing Service FY86 $155,265
Princeton, NJ FY88 $ 9,108
Elem Science

"Development of Science Materials For Beginning Readers: A Demonstration Project"

The purpose of this project is to develop materials for beginning readers (kindergarten to third grade) that will promote children's knowledge of and interests in areas of science while taking into account the tentativeness of their reading skills. Very little material is now available which meets these particular conditions. Not only will such material be of specific interest to many young readers, but it will enhance the competence of all children for understanding and appreciating the range of writing in science that they will encounter in the later grades.

The outcomes of the project will be twofold: (1) A prototype demonstration set of science books for beginning readers and (2) A project report that documents the development and effectiveness of the materials and provides guidelines and rationale for their use.

The project grows out of a program of classroom research on interests and learning styles of beginning readers which was conducted by ETS staff in collaboration with public school teachers. Research techniques developod in these previous studies will be used as a guide to constructing texts that have substantial science content yet are directly accessible to the beginner. The work of the project will entail collaboration with teachers, scientists and a writer.

RESEARCH IN TEACHING AND LEARNING

Thomas L. Hilton MDR 8652096
Educational Testing Service FY86 $228,313
Princeton, NJ FY87 $ 58,460
Studies

"Persistence in Science of High Ability Minority Students"

The proposed study is of the background, language proficiency, and educational progress of Asian American students of high mathematical ability who intend to enroll in college and to major in mathematics, science, engineering, or medicine (MSE). It is proposed as a supplement to an NSF-funded study of persistence in science of high ability minority students: Black, Mexican American, Puerto Rican and American Indian college-bound seniors with MSE plans, with comparisons to be made with White students of similar ability and interests. The Asian American project would complement and round out the minority persistence study, since two-thirds of high ability, college-bound minority students with MSE plans and one-tenth of all high ability, college-bound, MSE, high school seniors are likely to identify themselves as being Asian American. The study will link educational, personal and background factors of high ability Asian Americans, from Student Descriptive Questionnaire responses available in the College Board program division files, to follow up survey data relevant to persistence in mathematics, science, engineering, and medicine. Together with parallel findings from all other groups of the minority MSE persistence survey, the results will identify characteristics and experiences of persisters and nonpersisters at various time points, and improve understanding of policies and practices most likely to encourage, facilitate, and improve retention among all talented youth with hopes for a future in science and technology.

STUDIES AND ANALYSES

Thomas L. Hilton	OSPA 8842054
Educational Testing Service	FY88 $4,844
Princeton, NJ	Studies

"A Comprehensive Data Base for Science Indicators- A Feasibility Study"

This is a supplement to a grant to assemble, publish, and disseminate a sourcebook of findings from a research project previously funded by NSF. The project was to design and develop a statistical system and comprehensive data base to provide annual indicators of the quantity and quality of science and engineering students. The sourcebook will contain information that will reflect twenty-five years of experience with large educational data bases, beginning with Project TALENT in 1960 to the conclusion of High School and Beyond (HS & B) in 1984. This book will be "must reading" for future researchers proposing to use data from two or more data bases, especially those from the National Assessment of Educational Programs (NAEP), the SAT Program, the National Longitudinal Survey of 1972 (NLS), HS & B, or Project TALENT.

STUDIES AND ANALYSES

Nancy A. Mead	OSPA 8751498
Educational Testing Service	FY88 $184,400
Princeton, NJ	FY89 $ 75,000
	Studies

"An International Comparison of Thirteen-year-old Students in Mathematics and Science"

This project is for the conduct of an international assessment in science and mathematics of 13-year old students. In 1988, six countries will participate in the assessment (Great Britain, Korea, four provinces in Canada, Ireland, Spain, and the United States). Items selected from the National Assessment of Educational Progress (NAEP) will be used to test 2,000 students in each of the six countries. A report of findings showing the relative achievement of U.S. students vs. the other countries will be issued within 18 months of the conduct of the assessment.

This project is co-funded with the Department of Education.

COLLEGE SCIENCE INSTRUMENTATION

Dale E. Vitale	USE 8750267
Kean College of New Jersey	FY87 $30,850
Union, NJ	Chemistry

"An Integrated Approach to the Teaching of NMR Methods at the Undergraduate Level"

The applications of nuclear magnetic resonance (NMR) spectroscopy to both "static" investigations like the elucidation of molecular structure and to "dynamic" ones like the measurement of the rates of physical and/or chemical processes illustrates the versatility and utility of NMR in spanning the chemical disciplines from organic to inorganic chemistry. The recent acquisition of a continuous wave NMR spectrometer by the Chemistry Department at Kean College of New Jersey allows the application of these techniques in an integrated and cohesive way across the curriculum, thus providing the students, twenty four per cent of whom are minorities, with invaluable training and an intellectually stimulating theme in their scientific education.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Georgia Larsen	MDR 8850354
Burr Kansas	FY88 $250,000
Recording for the Blind Inc	FY90 $250,000
Princeton, NJ	FY91 $250,000
	Other NEC

"Program to Upgrade Capacity to Record Science Books for Blind Pre-College Students"

RFB is undertaking a program that will upgrade its capacity to meet the increasing demand by its blind borrowers, particularly at the pre- college level, for taped books in mathematics, science and technology. To accomplish its program RFB has entered into a partnership with the American Association for the Advancement of Science for the purpose of finding scientists who will record these books as volunteers in our 29 studios across the country. RFB will also establish a new studio to specialize in recording these books. And it has selected several of its established studios to put more emphasis in recording such books. The staff of RFB studios will be increased and trained to handle the additional work involved.

COLLEGE SCIENCE INSTRUMENTATION

William J. Bacha, Jr.	USE 8750222
Rutgers University Camden	FY87 $6,575
Camden, NJ	Biology

"Equipment for Preparing Plastic Histologic Sections for an Undergraduate Light Microscopy Program"

Undergraduate Biology students enrolled in a course entitled Microtechnique and Its Applications are using the appropriate state-of- the-art instrumentation to enable them to successfully cut semithin (0.5-2.0 micrometer) plastic histologic sections. An LKB HistoRange Microknife Maker is being used to make glass Ralph Knives, which in turn are being used to cut tissue specimens in an LKB HistoRange Microtome.

These instruments enable the students to cut semithin sections of plastic-embedded tissue specimens. The processing of plastic sections is an important advance in modern technical histology. Stained, semithin preparations provide better detail of histologic structure than can be obtained by other methods. It is important, therefore, that undergraduates learn and practice the methodologies involved in order to keep abreast of current advances in the field.

COLLEGE SCIENCE INSTRUMENTATION

Harvey Lesser	USE 8750957
Rutgers University Camden	FY87 $23,976
Camden, NJ	Psychology

"Observational Laboratory in Developmental Psychology"

Equipment necessary to start an observational laboratory in developmental psychology and to expand the range of student independent study projects to include observational research, both in the field and in the laboratory has been obtained. Recording equipment, video and audio, and hand-held data collectors for field research are essential for demonstrating current observational research methods for students. An eye-tracker is also an invaluable asset in the developmental laboratory to demonstrate to students an important approach to the study of the development of perceptual and cognitive processes in individuals.

COLLEGE SCIENCE INSTRUMENTATION

David A. Prescott	USE 8750969
Rutgers University Camden	FY87 $14,535
Camden, NJ	Physics

"Update of the Microprocessor Laboratory Equipment"

The Physics Department at Rutgers University-Camden will upgrade its present microprocessor laboratory in order to keep the student laboratory work in step with the already updated lecture material and the changes in industrial employment demands. The Department will install fourteen microprocessor developmental study system units. Each unit will consist of a Motorola MEK68000ECB educational computer board, video display, cassette transport, and interconnecting cables. In addition, a network switch, two printers, and cables will be added for hardcopy of student output and system communication. The new equipment will give the student hands on exposure to the latest 16/32 bit CPU architecture. The laboratory exercises will illustrate synchronous and asynchronous data acquisitions and control, 16/32 bit bus architecture, 8/16 bit I/O control, higher level assembly language programming and co- processing techniques with other CPU families. In addition, present laboratory support equipment will afford the opportunity of using higher level system development tools such as Pascal, C, trace analyzers, and process emulators.

TEACHER ENHANCEMENT PROGRAM

George J. Pallrand	TPE 8751352
Sidney Millman	FY87 $170,143
Rutgers University New Brunswick	Physics
New Brunswick, NJ	

"The Leadership Institute for Teachers of Physics"

The Leadership Institute for Teachers of Physics will enable twenty-four high school teachers of physics to have background lectures, discussions of teaching strategies, and on-site visits to research laboratories during a four-week summer program before they introduce four physics modules of material of current scientific interest into their own courses. High school science teachers have worked with Rutgers University faculty, industrial scientists at AT&T Bell Laboratories and Bell Communications Research to develop the modules: Lasers and the Nature of Light, Lightwave Communication, Magnetism and Magnetic Recording, Semi-conductors and Transistors. After the summer institute, the Lead Teachers will receive continuing logistic and scientific support through the Center for Mathematics, Science, and Computer Education in their efforts to introduce the modules into their own courses and to hold workshops for other science teachers. High school science teachers have worked directly with scientists as a five-member team to develop science modules, bridging the gap between institutions that are rich in science and technology and the schools. The project was funded by the New Jersey Department of Higher Education jointly with AT&T Bell Laboratories, Bell Communications Research, Merck and Co., and Rutgers University. The Leadership Institute will disseminate this material by providing high school science teachers with teaching units of current scientific and technological interest, provide the teachers with background scientific knowledge related to the units, help teachers develop strategies and techniques for better communication with illustration of scientific principles as well as new developments in science and technology to students, establish continuing relationships among teachers, university personnel, and industrial scientists.

Teachers, science supervisors, and other school administrators have been involved in all phases of the planning from the beginning. A feature which is particularly successful is the acceptance of teachers as colleagues and collaborators by the industrial and university scientists. The teachers found the work with the scientists to be professionally rewarding. The teachers are themselves involved in the creation of the materials which they will use in their classrooms.

TEACHER ENHANCEMENT PROGRAM

George J. Pallrand	TPE 8751759
Sidney Millman	FY88 $234,010
Rutgers University New Brunswick	Physics
New Brunswick, NJ	

"National Leadership Institute for Teachers of Physics"

National Leadership Institute for Teachers of Physics is a two-year project for 30 well-prepared high school physics teachers from all regions of the United States. The program is designed to help these teachers become familiar with several aspects of modern physics. This is done through the use of modules which emphasize areas of modern physics with widespread technological applications. The four physics modules -- Lasers and the Nature of Light, Lightwave Communication, Magnetism and Magnetic Recording, and Semiconductors and Transistors-- have been developed in collaboration with scientists from AT&T Bell Laboratories and Bell Communication Research (with partial support from a prior NSF grant). University and industrial scientists will provide background lectures to increase the depth of teacher understanding of the modules.

Participants will be selected from among the best high school teachers in the country. Each will be required to provide assurances from local school officials that they will be able to carry out the in-service activities needed to help other physics teachers to become familiar with the new modules. The program includes academic year support and second year follow-up for the leadership teachers.

TEACHER ENHANCEMENT PROGRAM

George J. Pallrand	TPE 8850442
William H. Sofer	FY88 $146,034
Rutgers University New Brunswick	Biology
New Brunswick, NJ	

"Leadership Institute for Teachers of Modern Biology"

This project will improve the teaching of the biological sciences by involving teachers in the design and formulation of new teacher educational materials while, at the same time, providing them with authoritative and current background information in the biological sciences.

The modules around which the program is organized were developed during previous summers in Institutes held at Merck and Co. in Rahway, New Jersey and the Waksman Institute at Rutgers University. The modules consist of experimental laboratory-based activities and supporting background information. A four-week summer institute will be held for 20 high school biology and biology/chemistry teachers from the New Jersey area. A series of Background Seminars in science will be presented by university and industrial scientists to provide teachers with knowledge on the module topics. These seminars will provide both an up-date on current research and the background science necessary for the teachers to maintain a good fundamental understanding of biology and biochemistry.

During the academic year the participating teachers will introduce the modules in their respective schools and present the modules to others teacher groups.

Two kinds of follow-up actives will be conducted. The first is a series of four meetings to be held during the academic year. The second follow-up meeting will be a one-week institute to be held the following summer. This project is significant since it is a strong collaborative effort of University and industrial research scientists and high school teachers. The project allows the scientists to focus on the subject matter while the teachers provide expertise based upon their experience.

Rutgers University has contributed an amount equal to 10% of the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Alois J. Riederer	USE 8750950
Trenton State College	FY87 $45,683
Trenton, NJ	Electrical Eng

"An Undergraduate Automated Test and Measurements Laboratory"

The objective of this project is to set up an exemplary automated test and measurement laboratory for undergraduate education. It will include twelve workstations using IBM PC/AT level microcomputers controlling an array of Hewlett-Packard test instrumentation. Upon completion of this laboratory, all manual test and measurement instruments in the curriculum will be replaced by computer-controlled, multi-point instrumentation.

FACULTY ENHANCEMENT PROGRAM

Jean Lane
Jacqueline DeMarzio
Jeffrey C. Jones
Charles J. Miller, Jr.
Nancy Maulding
Union College
Cranford, NJ

USE 8854159
FY88 $47,386
Mathematics

"Workshop on Applications of Discrete Mathematics"

Discrete Mathematics is a subject that is being pushed to the forefront of mathematics curriculum revision, and there is considerable debate over the topics that should comprise such an undergraduate course, and over its placing in the curriculum sequence. Many two year colleges are currently developing a Discrete Mathematics course as a service course for Computer Science. Mathematics Association of Two Year Colleges of New Jersey will offer a Workshop on Applications of Discrete Mathematics. Dr. Fred Roberts of Rutgers University, who is recognized as a major force in current Discrete Mathematics development will conduct this workshop. The workshop will consist of two sessions with a summer between them. Thirty participants from two year colleges in New Jersey and eastern Pennsylvania will be chosen. Discrete Mathematics has become so important because of the enormous variety of applications of the subject. These workshops will explore such applications to genetics, engineering, computer science, and social planning. During the three months between sessions, each participant will work on individual or small-group projects. The results of these projects will be evaluated during the Fall sessions. Participants will receive a printed summary to the group's activities to share with colleagues and students at their home institutions.

In addition to NSF support, participants will contribute about 15% in travel costs toward the project, and the grantee institution will contribute another 5% in support costs.

TEACHER ENHANCEMENT PROGRAM

Carolyn Q. Wilson
Woodrow Wilson National
Fellowship Foundation
Princeton, NJ

TPE 8652437
FY87 $303,040
FY88 $310,935
Physics

"National Science Leadership Program"

The Woodrow Wilson National Fellowship Foundation (WWNFF) will conduct a four-week summer institute for fifty high school physics teachers each year (1987-88) on the Princeton University campus. During the academic year, each teacher who participates in the institute will conduct regional workshops for other physics teachers over the nation. The WWNFF staff will provide support for teachers conducting regional workshops.

The goals of this proposal are to engage teachers in the development of curriculum materials in cooperation with university faculty, to develop leadership skills, and to design teaching strategies which will concentrate on developing students' abilities to make use of knowledge within the discipline and in related disciplines.

During the academic year, the WWNFF will provide support for local and regional workshops conducted by the summer institute participants. Funds for these activities will be awarded on a competitive basis. The institute staff will assist teachers in the development of regional projects to ensure that they are designed to be conducive for use in teachers' classrooms.

Also, the WWNFF staff will coordinate requests for mini-institutes to be conducted by the institute participants for precollege mathematics and science teachers at regional, state, and national meetings. The Foundation will monitor, coordinate, and disseminate the activities of this year's participants and those who were trained in previous institutes. These activities will be accomplished by staff visits, a monthly newsletter, and correspondence between the director and participants.

TEACHER ENHANCEMENT PROGRAM

Carolyn Q. Wilson
Woodrow Wilson National
Fellowship Foundation
Princeton, NJ

TPE 8550891
FY86 $370,008
FY87 $375,000
FY88 $350,000
Chemistry

"National Science Leadership Program"

This project is a 36-month program for 50 outstanding high school chemistry teachers from throughout the country. This program provides the content and pedagogical training in selected areas of chemistry for participants who will then conduct one-week outreach sessions for other teachers. The program, which is in its third year, will emphasize topics in biochemistry this summer. The 50 leadership teachers will participate in a one-month workshop. This grant also funds stipends for 50 outstanding high school mathematics teachers, who will participate in a similar one-month workshop. The mathematics teachers will conduct similar one-week outreach workshops for less well-prepared mathematics teachers. The emphasis in the Woodrow Wilson Honors Workshop programs in chemistry, physics, and mathematics is on the selection of participants with the highest level of content competency and leadership potential.

NEW MEXICO

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Larry D. Powell
Science
Dora Consolidated Schools
Dora, NM

Catherine E. Strong
Mathematics
Los Alamos High School
Los Alamos, NM

1988

Mary M. Hackler
Mathematics
Capshaw Junior High School
Santa Fe, NM

Julianne N. Green
Science
St Pius X High School
Albuquerque, NM

COLLEGE SCIENCE INSTRUMENTATION

David W. Johnson	USE 8750401
College of Santa Fe	FY87 $12,999
Santa Fe, NM	Biology

"Equipment for Improving Undergraduate Studies in Physiology and Microscopy"

As part of a major institutional effort to enhance the Biology program for science majors, prospective science teachers, and non-science students, this project is providing two types of laboratory equipment: a physiograph system for detecting, recording, and quantifying basic physiological functions, and stereoscopic microscopes for examining and identifying small organisms.

The equipment is being used by a variety of students, from first-year Biology majors and Science Education students to advanced students conducting independent research. About one-half of the students belong to an underrepresented minority -- Hispanic, Native American, or Black. A substantial number also are non-traditional, older students acquiring advanced education in order to enhance their ability to work in science- or technology-related employment. Most are women.

TEACHER ENHANCEMENT PROGRAM

Judith Kaye	TPE 8751676
Los Alamos National Laboratory	FY88 $85,914
Los Alamos, NM	FY89 $88,910
	Mathematics

"Mathematics Institute for Teacher Enhancement (MITE)"

This two-year project, which combines instruction in content and pedagogy with exposure to diverse applications of mathematics, is designed to improve the overall quality of middle school mathematics instruction in northern New Mexico. Each year, 25 mathematics teachers from grades 6 through 8 will participate in a four-week summer session that will strengthen their knowledge and understanding of mathematics, enhance their teaching skills, and familiarize them with curricular materials especially designed for Native American students. Through a program of presentations by employees of Los Alamos National Laboratory and tours of its facilities, they will also learn about the applications of mathematics in a wide variety of careers. Follow-up activities during the academic year will reinforce the skills learned in the summer and monitor the participants' activities in the classroom. During the first year, the project will focus on middle school teachers who are certified to teach elementary school; the second year's activities will be targeted at middle school teachers with secondary certification.

This project provides a model for collaboration among districts, universities, and scientific laboratories to improve mathematics education. Los Alamos National Laboratory has made a substantial commitment to the project in the form of in-kind contributions.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Jeffry Gottfried	MDR 8550535
Don B. Croft	FY86 $181,186
New Mexico Museum of Natural History	FY87 $194,549
Albuquerque, NM	Biology

"Improving Natural Science Education in Rural Elementary Schools"

This project is a cooperative effort between the New Mexico Museum of Natural History and the Center for Rural Education of New Mexico State University. It brings together scientists and educators for the purpose of improving science education in rural elementary schools.

The project will develop hands-on kits and working models on a number of related topics. Kits will use locally available specimens, background material, scientific apparatus, and suggested activities to teach natural science concepts. Working models such as stream tables to demonstrate the evolution of landforms and terraria mini-environments to demonstrate ecological relationships will be developed. Teachers' manuals will be written and workshops offered to train teachers to properly use the kits. Teachers will also receive training in the development of additional kits specific to their local conditions. The materials will be designed for use with multi-cultural populations and will build upon existing knowledge of rural children. Activities also include the establishment of out-of-school natural science.

INFORMAL SCIENCE EDUCATION

Paul R. Kemp MDR 8751429
Jeffry Gottfried FY87 $298,866
Caren Walt Museums
David D. Gillette
New Mexico Museum of Natural History
Albuquerque, NM

"New Mexico's Seacoast: Interactions, Past and Present"

The New Mexico Museum of Natural History in Albuquerque will design and construct a 6,250 square foot permanent exhibit on the geology and biology of the intracontinental Cretaceous Period seacoast environment of New Mexico. Using more than 20 interactive exhibits as well as modern and extinct plant and animal species, visitors will experience and explore this ancient, yet familiar world and develop a sense of the relationships between past and present, living and dead, extinction and survival as well as the continuity of natural processes.

The Museum will also construct related traveling exhibits for statewide display and install semi-permanent satellite exhibits in four communities that have relevant geologic and paleontologic resources. Exhibition designs will be based on formal and informal studies of exhibit effectiveness, systematic study of learning styles of visitors to the New Mexico Museum of Natural History, and interaction with schools throughout New Mexico.

This new natural history museum has an impressive staff, a record of institutional development and of state-wide community service, and a clear plan for carrying out informal science education with regional themes that serve the varied populations of New Mexico. The museum presently receives about 375,000 visits a year, of which 70,000 are in organized school groups with 45% Hispanic and/or Native American children. There is a substantial outreach program and extensive relationships with teachers and schools throughout the region.

COURSE AND CURRICULUM

Marcus S. Cohen USE 8813904
Edward D. Gaughan FY88 $83,572
R. A. Knoebel FY89 $96,695
Douglas S. Kurtz FY90 $48,621
David J. Pengelley Mathematics
New Mexico State University
Las Cruces, NM

"Student Research Projects in the Calculus Curriculum"

Mathematicians from New Mexico State University (NMSU) will continue to develop and implement a plan using student research projects in a broad range of Calculus courses.

During the first two years NMSU will use three individual two-week projects instead of hour exams in thirty-five calculus sections. New Mexico Institute of Mining and Technology, University of Texas at El Paso (UTEP) and Western New Mexico University will each teach three sections using the student research projects mode. Almost one-third of the students at NMSU and a half of the students at UTEP are minorities.

A collection of four hundred problems, many annotated with information on their success in the classroom will be compiled. These projects require that students think broadly and deeply, identifying background material and synthesizing an approach. Scientists, engineers and economists will help design projects which demonstrate the mathematical underpinnings of solutions to applied problems.

There will be faculty workshops, training of teaching graduate assistants, Advisory Committee meetings and an extensive evaluation. The latter includes evaluating long term intellectual growth of students.

NMSU is providing approximately 40% of the cost of the project.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

FACULTY ENHANCEMENT

Steven R. Brueck USE 8854282
John G. McInerney FY88 $97,623
University of New Mexico Physics
Albuquerque, NM

"Undergraduate Faculty Enhancement in Semiconductor Optoelectronics"

Semiconductor optoelectronics is becoming increasingly important in science and engineering. It is therefore highly desirable that engineers and scientists should be introduced to optoelectronics. Much of the relevant material can and should be incorporated in undergraduate curricula.

The Center for High Technology Materials at the University of New Mexico, in partnership with Sandia National Laboratories, will conduct a two-week workshop in semiconductor optoelectronics for undergraduate teaching faculty in university Physics and Engineering Departments. The workshop will include lectures, laboratory tours/demonstrations, and hands-on laboratory sessions in epitaxy of III-V direct-gap semiconductors, fabrication, processing and characterization of optoelectronic devices such as semiconductor injection lasers, and applications such as optical fiber communications.

This project aims to facilitate the inclusion of semiconductor optoelectronics in undergraduate Physics and Engineering by developing within faculty a basic knowledge and appreciation of the subject, providing direct contact with some of the latest experimental and theoretical advances, and by establishing an ongoing and mutually beneficial interaction between undergraduate faculty and a national center of excellence in the field.

In addition to the NSF funds, participants' institutions will contribute about 10% in travel costs toward the operation of the project.

TEACHER ENHANCEMENT PROGRAM

Paul W. Tweeten	TPE 8550233
University of New Mexico	FY85 $158,092
Albuquerque, NM	FY86 $129,544
	FY87 $129,544
	Computer Science

"Computers in the Science Classroom"

In this project, 35 New Mexico secondary school science teachers will participate in an eight-week summer workshop designed to emphasize the utilization of microcomputers in science teaching.

The summer component will address two issues: (1) the acquisition of computer knowledge, and (2) the application of computer knowledge in science teaching. Topics included during the eight week sequence include an elementary introduction to computer science, data communication and database resources, computer-aided instruction, an introduction to Pascal and BASIC, the computer as a problem-solving tool in the science classroom, and using the computer to foster problem- solving skills and creativity in secondary school science.

An associated academic year follow-up will utilize a computer network for communication between participants and university computer science and education personnel, to implement project outcomes and encourage wider dissemination in the school systems of New Mexico.

NETWORKS PROGRAM

Paul W. Tweeten	TPE 8751198
Jack Gittinger	FY87 $60,367
University of New Mexico	FY88 $47,888
Albuquerque, NM	FY89 $40,895
	Communication

"State/Regional Computer Networking-Teacher Training-Dissemination"

This project will support the dissemination of a model for state and regional computer-based communications networks for science educators. The source of the prototype and research base for these networks is CISCO-Net, the successful information system which has been implemented statewide in New Mexico.

In order to facilitate the establishment of these information systems, the University of New Mexico project team will develop and make available a support package for interested system sponsors. This assistance will include: (a) on-site preliminary consulting and planning services; (b) the required networking software; (c) a listing of the required networking hardware and its installation; (d) training for the host-site support staff; (e) a complete training package which the implementing site can use to prepare potential users of the information system; (f) a plan for evaluation and continuous updating of the system.

NEW YORK

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Joseph Quartararo
Mathematics
Northport High School
Northport, NY

George H. Stevens
Science
Lansing High School
Lansing, NY

1988

Robert Gerver
Mathematics
North Shore High School
Glen Head, NY

Paul Hickman
Science
Cold Spring Harbor High School
Cold Spring Harbor, NY

COLLEGE SCIENCE INSTRUMENTATION

Dan R. Bruss	USE 8750088
Albany College of Pharmacy	FY87 $31,700
Albany, NY	Chemistry

"Application of NMR Instrumentation in the Undergraduate Pharmacy Curriculum"

The Physical Science Department of the Albany College of Pharmacy has significantly enhanced its instrumental holdings by the recent acquisition of a nuclear magnetic resonance (NMR) spectrometer. The availability of this system is providing undergraduate students in pharmacy (forty per cent of whom are women) with practical experience in using NMR spectroscopy in several courses, including introductory organic chemistry, honors organic chemistry, drug analysis, and undergraduate research.

INFORMAL SCIENCE EDUCATION

Peter L. Galison	MDR 8850649
Pamela J. Hogan	FY88 $113,411
Spencer R. Weart	Physics
American Institute of Physics	
New York, NY	

"Superbomb: Physicists and the Decision to Build the Hydrogen Bomb"

The American Institute of Physics requests $113,411 over two years for partial funding for script development and production of a one-hour television documentary about the decision to build the hydrogen bomb. The program features the political, moral, and scientific policy debate of the 1940s and 1950s over whether to build thermonuclear bombs. It is targeted for national broadcast in 1990, the 40th anniversary of the decision to build the H-bomb. In addition to PBS broadcast, there are plans to distribute the film for use in high-school and university classes.

The project is being carried out by a partnership of noted historians of science and technology and an award-winning film maker, supported by experienced and prestigious advisors. It has received start-up funding from the AIP and several foundations, and has completed some interviews with participants in the "debate". Historical documents and film footage recently declassified are now available for inclusion in this documentary. Because of this availability of additional historical materials, the advanced age of the principals involved, and the anniversary tie-in, the timing of this project is particularly appropriate.

The content of this project is compelling: it is of both great historical significance and current relevance. The role of scientists as military, technical, and political advisors to the federal government is a fundamentally important historical issue that deserves public understanding. In addition, it is one of those relatively rare conceptually substantial topics that has the potential for gripping television. Project cost sharing will exceed $335,000.

John S. Rigden	USE 8751279
American Institute of Physics	FY87 $122,038
New York, NY	FY88 $117,400
	Physics

"Program to Develop New Approaches to Introductory Physics"

This project will enable the formation of a committee of physicists who will lead a thorough reexamination of the undergraduate introductory physics course. Over a period of two years the committee will consider issues relating to the introductory course and hold meetings, often in conjunction with major meetings of the American Association of Physics Teachers and the American Physical Society, in order to encourage discussion of the issues in the physics community. It will sponsor two conferences of physicists which will develop a variety of ways to design introductory courses to reflect the needs of students of physics and to reflect the current way physics is done. Through meetings and reports the committee will establish a consensus in the community about what kinds of approaches are valuable, and it will encourage the development and wide distribution of courses based on these approaches.

NETWORKS PROGRAM

John J. Russell TPE 8751392
American Physical Society FY87 $177,925
New York, NY Physics

"Physics Alliances - A Program for School-College Collaboratives"

One of the most valuable underutilized resources in strengthening school science programs is the pool of physics knowledge, laboratory equipment and technical expertise resident at neighboring colleges. This project aims to increase the numbers of students studying physics and the quality of the instruction they receive by increasing the physics knowledge and teaching resources shared between school and college instructors.

This sharing will be supported by the formation of local alliances among secondary school physics/physical science teachers and college physics instructors. The American Physical Society will sponsor regional workshops for school and college instructors who wish to form such alliances. The project will then provide experienced advice and support to newly forming alliances, and will link collaboratives together through an alliance newsletter and other publications.

COURSE AND CURRICULUM

C. T. Carley USE 8854556
Christian E. Przirembel FY88 $48,456
James A. David FY89 $35,397
John M. Sumansky Mechanical Eng
American Society of Mechanical
Engineers Foundation
New York, NY

"Mechanical Engineering Curricula for the 1990's: Implementing Change, Documenting Experience"

This project seeks to increase the level of concern about curriculum reform among Engineering educators in the Mechanical Engineering area and to provide a disciplinary environment that is much more supportive of revision and change in the undergraduate Mechanical Engineering curriculum than appears to exist at the present. The efforts include the following steps: 1) a conference of the Mechanical Engineering Department Heads to discuss ME curriculum during the Spring of 1989, 2) a program of "Awards for Exemplary Experiences with Mechanical Engineering Curriculum Change", 3) a follow-on step to determine what the impact of the curriculum innovation has been after a period of one year to keep attention focused on innovation in undergraduate programs in Mechanical Engineering. The grantee and the institutions of the participants provide funds that are an approximate match for the NSF award.

A valuable part of the project is the continuing publication of the papers about the various efforts to improve the curriculum. During the two years of the project this is expected to increase interest in and sensitivity about undergraduate education among those in the Mechanical Engineering education community.

This project is co-funded with the NSF Directorate for Engineering.

TEACHER ENHANCEMENT PROGRAM

Gerald Rhodes TPE 8751707
E. Jay Sarton FY88 $59,263
Board of Cooperative Educational Servs Astronomy
Binghamton, NY

"Solar Cycle 22 Project"

The Solar Cycle 22 Project will (in 1989-91) take advantage of the upcoming peak of the sunspot cycle to give twenty-four elementary and middle school teachers first-hand experience in studying solar activity and resultant earth effects. The project, sponsored by the Broome- Delaware-Tioga Board of Cooperative Educational Services and the Roberson-Kopernik Observatory, will assist teachers in incorporating scientific investigation into the classroom.

The core of the project will be a three-week Summer Teacher Institute which will culminate in curriculum development, with follow-up activities to include setting up solar mini-stations in schools so that students may collect sunspot data safely in the classroom. After the educational experience at the Observatory, the teachers will supervise data gathering at their home schools and disseminate their data through a communications network and series of sharing sessions. The project will stress the interdisciplinary nature of solar monitoring in that physical sciences, astronomy, earth sciences, and computer science will be involved.

COLLEGE SCIENCE INSTRUMENTATION

Joseph F. Bieron USE 8750139
Canisius College FY87 $22,291
Buffalo, NY Chemistry

"Chemical Separations and Microscale Syntheses"

Sophisticated methods of separation by gas chromatography with component identification by mass spectrometry, routine in the chemical profession, is now included in the undergraduate laboratory experiences in chemistry at Canisius College. An integral part of this development has been the acquisition of a gas chromatography/mass spectrometry system which, as a key component of, and in conjunction with existing instrumentation-FTIR, NMR, UV-Visible, HPLC, etc., is being used to develop new laboratory experiences in separations and microscale organic and inorganic syntheses. The microscale approach to chemical syntheses is very attractive because of shorter reaction times, faster work-up procedures, greater laboratory safety, and facile chemical waste disposal.

PRIVATE SECTOR PARTNERSHIPS

Joseph F. Bieron TPE 8851037
Canisius College FY88 $108,795
Buffalo, NY FY90 $160,525
Chemistry

"Laboratory Equipment Assistance Program (LEAP)"

To improve the scope and relevance of high school chemistry, physics, and biology laboratory instruction, a centralized pool of portable instruments will be established and experiments developed suitable for use with these instruments. These will be made available to high schools in the area around Canisius College, which will serve as the permanent home for the equipment pool. Cooperating industrial laboratories will offer teachers both short-term supporting hands-on laboratory training and full-time summer employment in their facilities. The portable equipment is being donated by industry and the college. Summer teacher enhancement programs emphasizing effective integration of the newly developed experiments into high school curricula will be offered by the college.

Cost sharing by the college and industrial firms will equal 79% of the NSF funding.

TEACHER ENHANCEMENT PROGRAM

Edward C. Kisailus TPE 8652012
Canisius College FY87 $105,898
Buffalo, NY FY88 $253,016
Biology

"Biology Interaction Group/Partnership in Education (BIG/PIE)"

This project provides continued development and enhancement of 25 to 35 biology teachers per year in western New York through participation in two-week summer workshops focusing on cell biology, chemistry, and comparative anatomy and physiology. New developments and techniques in the field are stressed and teachers develop materials to incorporate this knowledge into the high school biology curriculum. In addition to the summer workshop, monthly interactive sessions are held during the academic year with teachers, college staff, and a scientist with expertise in a certain relevant area. Field site visits to appropriate scientific centers or industries are also scheduled. Two secondary teachers also participate each summer in a one-to-one research experience with a college staff member.

The second major component of this proposal provides content and process background in natural and physical science to 30 elementary teachers per year in the same region. Materials are also developed to assist them in teaching science in their classrooms. Selected teachers involved in the high school workshops serve as teachers of the courses for elementary/ junior high school teachers and also serve as their mentors when both groups return to their school districts. The elementary/ junior high teachers also meet several times during the year and participate in certain field experiences.

This proposal results from a successful honors workshop for biology teachers developed and administered by the PI. The current project strengthens and extends the honors workshop and includes the elementary/middle school teacher component. The staff of the project are qualified both in background and experience. Leader secondary teachers are used during the workshop and in the schools to support those with less background and expertise in the middle and elementary schools. The college staff involves members of the biology, chemistry, physics, education and English departments.

COLLEGE SCIENCE INSTRUMENTATION

James A. Leone USE 8750291
Canisius College FY87 $37,890
Buffalo, NY Computer Science

"An Undergraduate Imaging and Operating Systems Laboratory Enhancement"

This project is to add four Sun 3/110C micro-computers to the imaging and operating systems laboratory. The courses associated with the laboratory will be radically changed to allow the teaching and experimentation in advanced graphics. Student research in the area of Lyndenmayer Systems will be conducted. In the area of operating systems, experiments in process scheduling, device handling, multiple asynchronous processes and paged virtual memory systems are planned.

TEACHER ENHANCEMENT PROGRAM

Bonnie Brownstein	TPE 8751356
Ellen Bialo	FY88 $186,531
Bert Flugman	FY89 $160,309
Center for Advanced Study in Educ	Computer Science
New York, NY	

"Experimenting with Robotics Leads to Further Understanding of Science, Mathematics, and Technology"

Experimenting with Robotics Leads to Further Understanding of Science, Mathematics, and Technology is a two-year project for 200 elementary and junior high school science and computer science teachers from New York City public and non-public schools to integrate the learning of fundamental principles in science underlying the microprocessor and electric circuits with logical operations and computer control. In eight Saturday workshops, teachers will build and use circuits, electromagnets, and transistors. Logo programs will control switches which will in turn control the robot each participant will build. Teachers will attend monthly follow-up meetings and be supported in the classroom by the project staff and volunteer scientists. Materials produced will include a manual and a videotape which document the enhancement.

This collaborative effort involves The Center for Advanced Study in Education (CASE) of the Graduate School and University Center, CUNY, The Institute for Schools of the Future (The PI is President), New York Community School Districts Board of Education, scientists who are members of the American Physical Society and the Robotics Research Laboratory of the Courant Institute of Mathematical Sciences, New York University, and the Center for Learning Technologies, New York State Department of Education.

INFORMAL SCIENCE EDUCATION

David D. Connell	MDR 8470622
Keith W. Mielke	FY85 $3,500,000
Children's Television Workshop	FY86 $3,484,402
New York, NY	FY87 $1,000,000
	Broadcasting

"A Children's Television Series About Mathematics"

The Children's Television Workshop (CTW) proposes to help alleviate the national crisis in mathematics education by producing a new daily public television series, a supplement to classroom education, for children 8-12 years old. The series will consist of 65 half-hour programs which will be ready for broadcast in the fall of 1986. The programs will be suitable for home viewing and in-school use. The series' educational content is planned to center on two complementary goals: the motivation to learn and use mathematics and the acquisition of certain problem-solving skills useful both in and out of school. Some of the objectives are intended to supplement classroom instruction, chief among them certain skills useful in applying mathematics to problems of the kind that people encounter in day-to-day life. Other objectives, included on an experimental basis, overlap more closely with the content that children in the target age range study in school.

This award is co-funded by the Department of Education. Additional funders of the series include the Corporation for Public Broadcasting, the Andrew W. Mellon Foundation, the Carnegie Corporation of New York, and IBM.

INFORMAL SCIENCE EDUCATION

David D. Connell	MDR 8751503
Joel Schneider	FY87 $3,000,000
Bettina Peel	FY88 $3,750,000
Keith W. Mielke	Mathematics
Children's Television Workshop	
New York, NY	

"SQUARE ONE TV: Two Additional Seasons of Mathematics Programs for Children on Television"

Children's Television Workshop (CTW) will produce two additional seasons of SQUARE ONE TV, a daily series of mathematics for children aged 8-12. The first season of 75 half-hour shows premiered on public television stations in January 1987. The second and third seasons will each consist of 65 programs to capitalize on the success of Season I and compound its educational utility. SQUARE ONE TV has three goals: to promote positive attitudes toward, and enthusiasm for, mathematics; to encourage the use and application of problem-solving processes; and to present sound mathematical content in an interesting, accessible and meaningful manner. Based on preliminary research results, the series appears to be meeting these goals. The series has attracted a substantial audience from throughout the country during its initial season, and a very positive reception from mathematicians, parents, teachers, and the press. Most importantly, the target-aged children are enjoying and learning from the series.

The goals and content for additional seasons will basically remain the same, with refinements made as research results are assembled and digested by in-house staff in conjunction with mathematics advisors. Production plans will take advantage of the learning experiences acquired from Season I.

The additional seasons of SQUARE ONE TV will be supported by a full range of promotion, community outreach activities and school services, including teacher's guides. Season II will air in September 1988.

The highly skilled production team responsible for season I remains in place: Dave Connell, Vice

President and Executive Producer, CTW; Dr. Keith Mielke, Vice President for Research, CTW; Dr. Joel Schneider, Content Director, SQUARE ONE TV; and Bettina Peel, Director of Research, SQUARE ONE TV. An 18-member National Advisory Board is chaired by Dr. Gerald Lesser, Bigelow Professor of Education and Developmental Psychology at Harvard, and more than 15 additional distinguished mathematicians, scientists, and educators serve as project consultants.

With the addition of SQUARE ONE TV to the existing 3-2-1 Contact science series, America's children now have a full hour a day of math and science learning opportunity at home. Continued development of SQUARE ONE TV mathematics programs is essential to sustain our national commitment for improved mathematics and scientific literacy for our young.

INFORMAL SCIENCE EDUCATION

Al Hyslop	MDR 8317404
Keith W. Mielke	FY84 $3,000,000
Children's Television Workshop	FY85 $2,000,000
New York, NY	FY86 $2,755,500
	FY87 $3,000,000
	FY88 $3,278,209
	Broadcasting

"3-2-1 Contact -- 100 Half-Hour Television Programs For Children About Science and Technology"

The Informal Science Education Program has led in providing federal support for planning, development and production of the daily children's science television series, "3-2-1 Contact." In the first 13-week season it reached some 23 million home viewers, including 6 million homes without children. The fourth season compared favorably with the first, reaching 14 million viewers in four weeks.

The series was developed with advice, counsel and assistance of over seventy experts -- educators, scientists, psychologists, broadcasters, parents, teachers, curriculum designers. Over 1,000,000 teachers' guides have been requested and the series has received the "Advancement of Learning" award from the National Education Association. The program has also received the Prix Jeunesse International Children's TV award, four "Emmy" awards, a special citation from Action for Children's Television celebrating achievement in children's television, The Parents' Choice Award, and "first place" awards from the National Society for Professional Engineers Annual Electronic Media Awards and the National Commission on Working Women's "Women at Work Broadcast Awards".

The Girl Scouts of America and the Girls Clubs of America have developed new science programs based on and extending the activities of the series. In addition, a number of science museums have begun weekend children's programs capitalizing on the enthusiasm generated by "3-2-1 Contact". Foreign versions have been co-produced for Germany, France and Spain and programs have been dubbed in Spanish for broadcast in Venezuela, Chile, Ecuador, Peru, Columbia, Costa Rica and Panama; an English version is being broadcast on the Armed Forces Radio/TV network and in Australia, New Zealand, Brunei, Malaysia, Singapore, Sri Lanka, Barbados, Bermuda, St. Maarten, Trinidad, Nigeria and Ireland.

A supplement was awarded in FY1988 as a result of discussions between the Informal Science Education program, the Division of Polar Programs' Polar Information Program, and CTW 3-2-1 Contact staff. With the airing of a week of Antarctica programming on 3-2-1 Contact this fall, there is a unique opportunity to promote 3-2-1 viewing among the target audience of children. In addition, a substantial increase in interest in information and material regarding Antarctica will result, creating the opportunity for improved distribution of appropriate educational materials. Based on existing levels of requests for information to the Polar Information Program office, a substantial increase in requests should result.

This project is co-funded with the Department of Education.

TEACHER ENHANCEMENT PROGRAM

David A. Micklos	TPE 8751248
Cold Spring Harbor Lab	FY87 $415,928
Cold Spring Harbor, NY	Biology

"A Teacher Enhancement Program to Stimulate Laboratory-based Instruction in DNA Science for Advanced Placement and Honors Biology Classes"

Using lab-teaching technology developed at their laboratory, Cold Spring Harbor will hold teacher training workshops at six locations in the Northeast, Southeast and Midwest each summer, 1987-89. A mobile DNA laboratory carries all the equipment necessary to perform with 24 participants a series of nine experiments which culminate in the production and analysis of a recombinant-DNA molecule.

On-site preparation is coordinated by a local organizer at the host institution. Although the program is designed to select advanced placement and honors teachers, a proportion of similarly-qualified general biology teachers will be selected.

COLLEGE SCIENCE INSTRUMENTATION

Robert M. Arnold	USE 8851474
Colgate University	FY88 $18,321
Hamilton, NY	Biology

"Computers for Undergraduate Ecology and Population Biology Laboratories"

The Department of Biology is making IBM-compatible microcomputers available to its students at all levels of the Ecology curriculum. The inadequate computer hardware and software within the Department previously available for student use is being augmented by laptop microcomputers to collect and analyze data both in the field and in the laboratory; external hard drives to provide storage space for data; professional-level statistical software packages; dot-matrix printers; a plotter; and a video projection system.

The courses in which computers are having the greatest immediate impact are "Computers in Biology" and "Ecology", both of which are intermediate-level courses, and "Population Biology", an advanced-level seminar course that includes an independent research project. The computer expertise developing in the Department, together with a strong university commitment to computing, justify the development of a Biology curriculum in which computers play an important role.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Thomas J. Balonek	USE 8750955
Colgate University	FY87 $32,297
Hamilton, NY	Astronomy

"High Sensitivity Charged Coupled Device (CCD) Imaging in Undergraduate Astronomy"

Charged-coupled devices (CCDs) are being increasingly used as sensitive imaging devices on small optical telescopes. The high quantum efficiency and low noise of these array devices permit their use as faint object detectors, so that a small telescope equipped with a CCD camera is operationally equivalent to the largest astronomical telescopes of a decade ago. Colgate University will acquire a high sensitivity cryogenically cooled CCD array imaging system for use with its campus 16-inch telescope to train students in techniques of high accuracy spatial and intensity measurement. Use of the CCD camera system will enable students to work with recent technology such as electronic array detectors, cryogenics, electronics, microcomputers, computer interfacing, computer programming, image analysis, as well as fundamental astronomical research. There are a wide range of astronomical projects which can be conducted by undergraduate students with this instrumentation: imaging of extended or faint objects such as galaxies, nebulae, and star clusters to study their structure and composition; search for the study of transient events such as supernova in distant galaxies, flaring in cataclysmic variable stars and dwarf novae, and motions and changes in appearance of comets and asteroids; monitoring of the optical continuum spectrum and time variability in stars, quasars, and active galaxies. With a device capable of sensing faint astronomical objects, students will become involved in research, using recently developed electronic instrumentation, which is representative of projects being conducted by professional scientists.

COLLEGE SCIENCE INSTRUMENTATION

David K. Lewis	USE 8852990
Colgate University	FY88 $23,300
Hamilton, NY	Chemistry

"Incorporation of Gas Chromatography/Mass Spectrometry into Undergraduate Instruction"

A quadropole mass spectrometer and associated computer hardware and software for instrument control and data analysis is being acquired. The instrumentation is being interfaced to an existing packed column gas chromatograph, giving gas chromatography/mass spectrometry (GC/MS) and interactive data acquisition analysis capabilities which were previously nonexistent in the department. Students (both majors and non-majors) are using the apparatus in fulfilling laboratory assignments in Organic Chemistry, Instrumental Analysis, and Physical Chemistry courses. The equipment is also being used extensively by students in the required senior research program. While the program had previously integrated the chemistry subdisciplines within the laboratory program attached to individual courses, especially Instrumental Analysis, this is the first the vertical integration has been accomplished. The progressively challenging and instructive hands-on exercises centered around the modern GC/MS is the cornerstone of the program.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Thomas J. Myers	USE 8851192
Colgate University	FY88 $24,027
Hamilton, NY	Computer Science

"An Undergraduate Artificial Intelligence (AI) Laboratory"

This project supports the enhancement of an existing Artificial Intelligence course and the introduction of a new Natural Language Processing course at this institution. The equipment funded by this award builds on an already existing lab and includes: Sun 3/60/M-8 workstations and Zenith PCs interconnected (with existing equipment) via Ethernet. Using this laboratory, undergraduate students in Computer Science study not only theoretical issues of artificial intelligence and natural language processing, but also practical issues related to programming in these areas.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Christopher H. Nevison	USE 8750392
Colgate University	FY87 $35,892
Hamilton, NY	Computer Science

"An Undergraduate Parallel Processing Computer Laboratory"

This project will develop an undergraduate computer laboratory in parallel processing. The laboratory will be equipped with an INMOS, forty processor, parallel machine which can be flexibly configured in either ring, mesh, shuffle-exchange, or hypercube architectures. IBM PC/AT compatible machines will be used for both the front-end and as a development system.

Integrated with the laboratory will be a course on parallel processing covering the topics of architecture, algorithms, and programming languages. Topics on parallel processing will be integrated into the courses Analysis of Algorithms, Programming Languages, VLSI Design, Graphics, and Simulation.

COLLEGE SCIENCE INSTRUMENTATION

Robert F. Pohlman	USE 8750861
Colgate University	FY87 $50,000
Hamilton, NY	Biology

"Instrumentation for an Undergraduate Recombinant DNA Laboratory"

Instrumentation acquired through this project is being used to initiate a two-semester Molecular Biology course in which undergraduates learn recombinant DNA methodology in the laboratory. Major instruments include an ultracentrifuge with two rotors, UV spectrophotometer, power supplies, DNA sequencing apparatus, constant temperature shakers for bacterial growth, a scintillation counter, and two microcomputers with hard disks. The instruments will be used in a series of 10-week laboratory exercises each semester for students in the Junior year. These exercises will acquaint students with the growth of bacteria, bacteriophages and plasmids, the subcloning of phage genes into plasmid DNA, bacterial transformation with recombinant DNA, site-specific mutagenesis, the construction of a genomic library, nucleic acid filter hybridization, and an introduction to DNA base sequence analysis.

The course prepares students for active involvement in undergraduate research projects in Molecular Biology in their Senior year. The faculty anticipates that this course will create such enthusiasm that an increased number of students will consider scientific research careers in the fields of molecular and cellular biology.

COLLEGE SCIENCE INSTRUMENTATION

Nancy L. Pruitt	USE 8750793
Colgate University	FY87 $40,014
Hamilton, NY	Biology

"Physiological Instrumentation for Basic and Advanced Undergraduate Laboratories"

The Department of Biology is upgrading its basic Animal Physiology course with the acquisition of sophisticated, state-of-the-art equipment. The new equipment includes such electrophysiological instrumentation as microcomputers to interface with dual channel oscilloscopes, pressure transducers, polygraphs, and accessory equipment -- all of which have a wide range of applicability and flexibility. Students taught on this new equipment will be prepared to enter the upper level courses in the Department in such diverse subdisciplines as Physiological Ecology, Endocrinology, Advanced Cellular Physiology and Neurophysiology. The high percentage of students who pursue graduate education in Biomedical fields and the historically high demand for training in Physiology indicate that this equipment is being used productively.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Gilbert J. Lopez	MDR 8651523
Columbia University	FY 86 $372,476
New York, NY 10027	FY 88 $187,721
	FY 89 $166,773
	Mathematics

"Model Project to Increase Mathematics Achievement at the Secondary School Level"

This project will test an instructional strategy designed to increase the pool of minority students who are successful in their study of algebra and higher mathematics courses.

Since 1979, the Comprehensive Math and Science Program at Columbia University has been developing an instructional model designed to give all entering ninth grade students the opportunity to work to their highest level of capacity in mathematics. Key features of the model are a zero-based start, which makes no assumptions on students' prior mathematics background, and a complementary curriculum, which provides a set of parallel, interlocking mathematics courses that substantially increases the rate of mathematics instruction over a four-semester period. Preliminary tests of the model in New York City schools have yielded encouraging results.

In the current project, the instructional materials will be completed and the model will be extensively tested in New York City and in Fulton County, Georgia. The testing will be accompanied by the development of an apprenticeship model for teacher training, which will pair new teachers with experienced teachers in the interlocking courses of the program.

TEACHER ENHANCEMENT PROGRAM

Jack A. Perna	TPE 8751828
Sandra C. Jenoure	FY88 $194,984
Community School District #4	FY89 $209,878
New York, NY	FY90 $213,806
	Elem Science

"Enhancing Elementary Science"

Community School District 4 has designed the Elementary Science Enhancement Project to address the issue of effective science instruction that meets the State mandate. The purpose of this project is to enhance the quality of science teaching and thus the increased awareness and preparation of underrepresented elementary students in East Harlem. The project will, over three years, impact upon 30 supervisors, 500 teachers and 12,000 students. In New York this comes at a time when the State Education Department is introducing a new elementary science syllabus requiring enhanced teacher competence and "hands-on" involvement in science instruction. The immediacy and extent of need suggests an intervention model that operates at the level of direct instruction (the school district); that is organized to meet the in-service needs of current professionals; that institutionalizes a system of peer support, turnkey training, and supervisory involvement in every school; that develops a cadre of elementary science instructors/trainers for long term effectiveness; and that provides up- to-date information and materials, drawing upon the support and expertise of educational publishers, private industry, curriculum authors, scientists, and science educators. The project has a three-year plan in which teacher leaders are trained along with building level supervisors in order to provide on-going elementary science staff development and collaboration on a district-wide basis. The strategies formulated by this project will be shared with the 31 other school districts in New York City as a viable model for the implementation of the new science syllabus. The expertise developed in staff development will be a valuable resource for New York City schools as well as the 700 other school districts throughout New York State.

COLLEGE SCIENCE INSTRUMENTATION

Devdas Shetty	USE 8852135
Cooper Union	FY88 $60,213
New York, NY	Mechanical Eng

"Comprehensive Introduction of Computer Aided Engineering, Computer Aided Design and Manufacturing Facilities to the Undergraduate Curriculum in Mechanical Engineering"

The Mechanical Engineering students at this institution need additional exposure to computer-based engineering system and to the various stages of design, analysis, drafting, and manufacturing. This project provides an integrated computer-aided design/computer-aided manufacturing software package, precision graphics workstations, and a numerically-controlled vertical milling machine. This instrumentation is used as part of the required design-oriented Mechanical Engineering courses and associated electives. The students learn how to realistically simulate product performance in the initial design stage before committing to detailed drawings and manufacturing. This project creates a real-life computer-oriented design environment for the students and makes available a basic educational tool for general use in other disciplines.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Constantine Yapijakis	USE 8852336
The Cooper Union School Eng	FY88 $35,325
New York, NY	Civil Eng

"Environmental Engineering Laboratory"

This project permits undergraduate students to carry on experiments and individual research projects with an Upflow Pack-Bed Bioreactor. The pilot unit in this laboratory is used in conjunction with mutant bacteria cultures to study the effectiveness and kinetics of the aerobic fixed- film, submerged bed process in treating industrial and/or toxic wastewaters. The instruments funded with this award are necessary for monitoring the various parameters of the process and for analyzing various quality parameters in the raw and treated waste. The laboratory equipment includes: TOC Analyzer with accessories; TOD Analyzer with accessories; dissolved oxygen meters; COD test systems, BOD standard test units; spectrometer; binocular microscope; muffle furnace; glass still; total suspended solids analyzer; turbidimeter; balance; temperature logger; aspirator pump; and, other accessories.

This award is being matched by an equal sum from the grantee.

RESEARCH IN TEACHING AND LEARNING

Jere Confrey	MDR 8652160
Geraldine Gay	FY87 $234,095
Cornell University	FY89 $233,160
Ithaca, NY	Mathematics

"Exploratory Research on Student Understanding of Exponential Functions: Instruction Using Multiple-Representational Systems"

This project will conduct research on the development of students' conceptions of exponential functions. These Principal Investigators have selected exponential functions, a particularly rich and useful set of concepts, because of its propensity for misconceptions and its widespread and significant, applications in mathematics, the sciences and engineering. Through the use of clinical interviews and the teaching experiment, these investigators will examine students' conceptions, the relationships between their informal and formal knowledge, their interjections and use of concepts across a variety of contexts and the development of metacognitive strategies in the application of these concepts.

The project will explore the design and use of a multi-representatival (Laser Disc) instructional system, to explore options for using its vast memory storage for tracking student problem-solving strategies and student control of instruction.

Thus, these investigators hope to significantly advance our understanding of the development of student concepts and create a prototype unit in exponential functions for a precalculus course for high school and college students.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Robert E. Cook	MDR 8550295
Cornell University - State	FY86 $152,208
Ithaca, NY	FY87 $167,920
	FY88 $165,307
	Biology

"LEAP - A Program of Informal Science Education"

Plantations, the botanical garden and arboretum of Cornell University, is developing a model program of informal education for elementary (K-5) school children. Project LEAP, Learning About Plants, will integrate the academic resources of Cornell University, including the guidance of its practicing scientists and educators and the informal setting of its botanic gardens, with the teaching of mathematics and science in local elementary schools.

The project contains five components: (1) a conceptually-based curriculum of biology, ecology and agriculture which will include some components of SCIS (Science Curriculum Improvement Study) and OBIS (Outdoor Biology Instructional Strategies); (2) a teacher training workshop to stimulate curriculum integration and modification; (3) multiple two-way visits between Plantations and local schools providing children with direct experience with plants and animals; (4) a quantitative program of curriculum development and evaluation based on learning theory; and (5) a plan for dissemination of the structure and instructional contents of this program. Because children will experience LEAP over a period of years, the complex and meaningful learning of concepts in science will be achieved in the earliest years of a child's education.

Because LEAP is being designed to become a model program applicable to many institutions of informal education, two publications will be produced: a notebook which describes the overall structure of the program, and a handbook for teachers which presents the individual lessons of the curriculum and the theoretical background supporting the choice of curriculum material. The notebook will distinguish those elements of the program particular to Cornell and Plantations, and mechanisms through which the program can be adapted to other institutions.

FACULTY ENHANCEMENT

Kenneth G. Wilson	USE 8854207
Cornell University - Endowed	FY88 $120,000
Ithaca, NY	Computer Science

"A Combined Program for Research Experience for Undergraduates and Undergraduate Faculty Enhancement"

This project will combine undergraduate students with undergraduate faculty into teams which will explore supercomputing through training and research. Undergraduate students will learn the principles of supercomputing and, with their faculty advisor, formulate and execute a research project. Undergraduate faculty will have the opportunity to investigate supercomputing and to integrate that technology and methodology into their curricula. Specifically, a four- week Summer Short Course, "Supercomputing Tools, Methodologies and Applications", will be given for students at Cornell University. Work on the research projects designed by the attending teams will begin during the course and continue throughout the subsequent academic year under the supervision of the faculty advisor with the continuing support of the Cornell National Supercomputer Facility (CNSF) staff. Progress will be monitored through a series of reports and at a midyear convocation of the participants. Technical support and supercomputer resources will provided by the CNSF. Administration will be handled through this project's nationally-derived Steering Committee. Instruction will be by qualified persons experienced in undergraduate education, especially with respect to computing and numerical analysis.

By taking the unique approach of combining students and faculty to introduce the concepts and practice of supercomputing into the undergraduate experience, this proposal offers a special opportunity to those universities and colleges that may not have an emphasis on research or computing in their curriculum. By encouraging the integration of the materials provided through this program and the original courseware developed by participating faculty into the undergraduate curriculum, this program will stimulate the growth of undergraduate learning and interest in the technologies of computing and applications in research.

In addition to the NSF grant, participants' institutions will provide about 15% in travel costs toward the operation of the project.

This project is co-funded with the NSF Directorate for Engineering.

COLLEGE SCIENCE INSTRUMENTATION

Patricia R. Wilkinson	USE 8851194
CUNY Borough of Manhattan Community College	FY88 $37,421
New York, NY	Mathematics

"Project MICRO-CALC: Microcomputer for Classroom and Learning Center Calculus"

Borough of Manhattan Community College, the only public two-year college in Manhattan, will create a microcomputer classroom for its precalculus and Calculus courses. They will also add computers to their Learning Center for the use of the precalculus and Calculus students.

The precalculus and Calculus curriculum will be enhanced with interactive graphic activities which emphasize basic concepts, functions and their properties.

Half of the students will be majors in the newly established Science Concentration, Engineering Technology and Computer Science. The student population is 67% female and 83% minority.

The grantee is providing an equal sum for the equipment obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

James A. Fahey	USE 8852184
CUNY Bronx Community College	FY88 $11,013
New York, NY	Chemistry

"Microcomputer Based Introductory Laboratories Using Titrations"

This project is improving the quality and relevance of the first and second courses dealing with chemical analysis through the use of microcomputers and automated titrators. This is being accomplished through the use of four automatic titrators in conjunction with four microcomputers. This permits students to design and control automatic titrations; to collect and process data; to learn a greater number of volumetric methods including colorimetric, potentiometric and pH titrations; and to become familiar with the application of computers to new and old methods of analysis. The automatic titrator/computer is being used to do a series of titrations involving acids and bases; redox titrations; and potentiometric titrations. The equipment is being used to teach students about a greater number of analytical techniques and making it easier to use the laboratory experiments to reinforce theoretical topics covered in the lecture. It is also enabling the teaching of methods of analysis through the use of computer simulation. In addition many laboratory skills are being taught in a more efficient and meaningful manner through the use of computers in the laboratory setting.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Gerald H. Elgarten	TPE 8652350
CUNY City College	FY87 $123,610
New York, NY	Mathematics

"A Model Mathematics Inservice Program for Middle School Teachers"

This five-week summer program, based in New York City, will assist twenty-four master middle school teachers to upgrade their mathematical knowledge and teaching techniques, and to prepare/conduct workshops for co-teachers of grades 5 - 8. All teachers will be from New York City schools, where at least 80% of the their students are living at or below poverty level. The purpose of the workshops, run by the master teachers, is to assist the participating teachers better prepare their students to receive mathematical instruction and increase the students' rate of retention in mathematics courses.

The mathematical topics will include algebra, geometry, graphing, computers, probability, and statistics.

In addition, the City College of New York will finance the development and pilot testing of an instructional in-service videotape for middle school mathematics teachers. The intent is that teachers can view the tape as often as they want at their own convenience.

The project director is Gerald Elgarten, City College of the City University of New York. Claire Newman, Professor Emeritus, Queens College of the City University of New York, a well-known mathematics educator and Michael Engber of the Department of Mathematics, City College will conduct the two courses for four weeks and the one-week workshop. An Advisory Committee composed of superintendents and principals from the NYC public schools and the City College administration will meet several times prior to and once a month during the project to provide policy advice and to monitor and evaluate progress.

A continuing evaluation process will assess the project's impact on the teachers and their students.

CAREER ACCESS OPPORTUNITIES

Alberto Guzman	USE 8850610
CUNY City College	FY88 $719,872
New York, NY	FY89 $800,000
	FY90 $800,000
	FY91 $800,000
	FY92 $500,000
	Minority Center

"Comprehensive Regional Center for Minorities at City College"

This project was submitted by CUNY-City College with the cooperation of the CUNY-Graduate Center, CUNY-Hostos Community College, CUNY-York College, CUNY-New York Technical College, and the New York Public Schools. It builds on the experience gained through activities supported in the Northeast Resource Center for Science and Engineering established at City College in 1981 with major funding from the National Science Foundation. The goals of the project are to provide minority students with:

1. Strong precollege and college preparation in science, basic academic skills, and in the metacognitive prerequisites for effective thinking and problem solving.

2. Exposure to experiences, environments and individuals which nurture a sense of professional and personal self-confidence and an enduring interest in science and in science career objectives.

3. Opportunities to study advanced, specialized topics in science and engineering and to become involved in research with established scientists.

4. Visible and functional minority role models in science and engineering.

A set of coordinated activities, focussing in three areas: precollege (both students and teachers), undergraduate (both students and faculty), and informal science education are being implemented to achieve these goals.

Activities for precollege teachers include: inservice courses for precollege science and mathematics teachers emphasizing "hands-on" activities designed as models that integrate process and content to encourage participatory modes of teaching students; leadership training workshops for school principals and district science and mathematics coordinators to develop and implement detailed plans for innovation in these subject areas, and to train and motivate their teachers to participate fully in these new projects and programs.

Activities for precollege students include: Saturday Academies for elementary and middle school students which provide opportunities for them to engage in a series of exploratory research activities; and Summer Academies for high school students in which minority students attend a one-month summer program designed to develop students' science and mathematics skills, enhance their interest in pursuing advanced study and a career in science and engineering, and nurture their sense of personal and professional self confidence.

Activities focussed at the undergraduate level include: Transition Programs for entering freshmen and transfer students, an intensive one- month program which includes pre-testing in science and mathematics skill areas, mini-courses in mathematics, computing and laboratory techniques, college orientation, workshops in problem solving and study skills development; and career education presentations; Retention Programs for freshman, sophomores and transfer students which emphasize orientation sessions throughout the year, regular individualized academic counseling, a preparatory science course for underprepared students, frequent study group meetings with supervision by tutors, careful monitoring of academic progress and problems, and meetings with advanced undergraduate and graduate students to discuss academic and career issues; and undergraduate research opportunities in which students participate in independent research projects under the supervision of science and engineering faculty members.

The informal science education component includes activities for parent training and community education, a responsibility of CUNY- Graduate Center as a cooperating organization, with a variety of family and community focussed activities being undertaken. Two brochures, "A Parent's Guide to Careers in Science and Engineering" and "Studying Science and Mathematics: A Parent's Guide", together with a series of programs presented in a variety of community settings to increase the awareness of the minority community concerning science and engineering, careers in these fields, science education issues, and community resources related to science and technology are being implemented.

This project is a very good example of a Comprehensive Regional Center for Minorities. It is targeted at the minority population (black and hispanic) of New York City which is of substantial size (3.2M), and it is comprehensive in terms of attention to the various educational levels and age groups, in disciplinary coverage, and in its focus on nurturing, encouraging and motivating minority students. Significant additional support is being contributed to the project by the participating organizations and groups.

TEACHER ENHANCEMENT PROGRAM

Martin Marin	TPE 8751769
CUNY City College	FY88 $194,335
New York, NY	FY89 $209,012
	FY90 $226,797
	JHS Science

"Science Collaborative Project"

Science Collaborative Project is designed to serve 60 underprepared junior high school science teachers from minority school districts in New York City (Districts 4, 5, 6, 9, and 10). These teachers will take a specially designed sequence of four courses (summer session and academic year) at CCNY in physics, chemistry, earth sciences, and life sciences. These courses are designed to both improve the teachers' understanding of basic concepts in these four areas, and to extend their pedagogical skills in teaching physical and life science material in largely minority junior high schools. In addition, a major aim of the project is to improve the science skills and attitudes of minority students.

Approximately 45% of the science teachers in these five districts will participate. They will receive 18 graduate credits from CCNY for the course work. In addition, through collaboration with experienced junior and senior high school science teachers at Bronx High School of Science, participants will have the opportunity for extensive practice teaching during summer sessions. Participants are expected to attain a level of competency that would permit many of them to help other science teachers in their districts.

TEACHER ENHANCEMENT PROGRAM

Alfred Posamentier	TPE 8550991
Ellen E. Smiley	FY86 $156,189
CUNY City College	FY87 $143,994
New York, NY	FY88 $148,065
	Mathematics

"Enhancing Mathematics and Science Instruction"

This project, Establishing a Center for Science and Mathematics Education, was designed in consultation with the New York City Board of Education to improve elementary and secondary instruction in the New York City area. Activities include leadership training workshops for school principals and district science and mathematics coordinators, conferences on topics in mathematics and science education, and inservice mathematics and science courses. The workshops, conferences, and courses will have 720 participants. All the supervisors of mathematics and science in New York City will attend a conference to be addressed by Nobel Laureate Herbert Hauptman, an alumnus of the sponsoring institution, City College of New York. Courses include Logo for elementary school teachers and the use of computers in high school chemistry instruction. These courses, with accompanying video tapes and printed materials, will enable participants to convince other teachers to use new methods. The workshops prepare school principals and science coordinators to carefully analyze their programs and develop detailed plans for innovations in mathematics and science.

TEACHER ENHANCEMENT PROGRAM

Alfred Posamentier	TPE 8751706
CUNY City College	FY88 $189,320
New York, NY	FY89 $226,343
	FY90 $169,904
	Mathematics

"Teacher Enhancement Academy for Mathematics (TEAM)"

This two-and-one-half year project involving teachers, university faculty, parents, students, retired teachers, and school district personnel will significantly enhance the mathematics background and pedagogical skills of thirty-two underprepared eighth-grade mathematics teachers in a predominantly minority urban school district. Throughout the duration of the project, City University of New York (CUNY) faculty and master teachers will provide the participants with mathematics instruction in areas relevant to the curriculum. During the academic year, participants will also practice and improve their teaching techniques in a Saturday Mathematics Academy attended by eighty underachieving students and their parents. On a rotating basis, they will teach the students, observe their colleagues' teaching, and advise parents on ways in which they can support learning at home. Retired teachers will serve as mentors for the participants and will assist them in translating their experiences from the Saturday Mathematics Academy into their regular classrooms. The evaluation will involve participants, their students, and their students' parents. At the end of the project, a dissemination meeting will be held for administrators from other interested school districts.

The project is a collaboration between City College and New York City School District 10, which are contributing $286,478 in cost-sharing. Its combination of extensive instruction in content with regular opportunities to practice newly learned teaching techniques provides a model for significantly improving the qualifications of underprepared teachers that could be replicated by other urban school districts.

COLLEGE SCIENCE INSTRUMENTATION

Reuben L. Baumgarten USE 8750789
CUNY Herbert L Lehman College FY87 $36,216
New York, NY Chemistry

"Improvement of Instrument Based Instruction in Chemistry"

The recent acquisition of a state-of-the-art nuclear magnetic resonance spectrophotometer (Varian EM 360L) is enabling the chemistry department at CUNY Lehman College to implement major curriculum revisions in the organic chemistry laboratory courses, to introduce important NMR-based experiments in physical chemistry, instrumental analysis, and biochemistry, and to enhance student learning in undergraduate research. Since the undergraduate enrollment at this institution is predominantly minority, these revisions will significantly affect undergraduate instruction for this group which has been traditionally underrepresented in science, mathematics and engineering.

COLLEGE SCIENCE INSTRUMENTATION

Reuben L. Baumgarten USE 8853006
CUNY Herbert L Lehman College FY88 $69,000
New York, NY Chemistry

"Implementation of Gas Chromatograph-Mass Spectrometry for Undergraduates in Forensic Science and Organic Chemistry"

The addition of a gas chromatograph-mass spectrometer to the instrumentation available for the instruction of undergraduate students provides opportunities for students to have direct hands-on experience with this modern instrumentation. An undergraduate course in Forensic Science requires that the students conduct measurements using this instrumentation. The Introductory Organic Chemistry laboratory has been changed to include mass spectrometry experiments that develop the student's understanding of these experimental methods.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

John R. Gillespie USE 8750657
CUNY Herbert L Lehman College FY87 $6,694
New York, NY Physics

"Modernization of Introductory Physics Laboratories Using Computers"

The Department has undertaken an extensive program of modernization and extension of its entire laboratory program. The major theme of the project is the development of skills related to the acquisition, display, analysis, and interpretation of measured data. Instrumentation and microcomputers typical of modern research and industrial laboratories are being introduced. This project, as the next major step, involves the installation of microcomputers in the mechanics laboratories with direct interfacing to photogates for airtrack experiments. A pilot project last year with one set-up proved very successful. In addition a modern oscilloscope will be introduced for experiments on sound, AC circuits with reactance, and time-dependent DC circuits. A new experiment will be based on the oscilloscope itself. Now in its sixth year, the modernization program will be completed in another 4 years.

TEACHER ENHANCEMENT PROGRAM

John Niman TPE 8751234
CUNY Hunter College FY87 $143,921
New York, NY Environmental

"An Urban Environmental Program for Middle and Junior High School Teachers"

Hunter College of the City University of New York jointly with the Research Foundation of the City University of New York will develop an Urban Environmental Program for Middle and Junior High School Teachers with energy and environmental control as the main theme. The program includes workshops, lectures, demonstrations, field trips and a camping experience where the 70 participates will have the opportunity to compare and contrast urban and rural environments.

The objectives for the program include developing programs for teachers based on staff prepared materials, computer programs, and material prepared by NSF-sponsored curriculum projects and other national programs; enabling teachers to master the requisite subject matter and to acquire techniques for teaching urban environmental studies; assisting teachers to develop activities for the classroom and to implement them; providing problem solving experiences in science and improving the practice of techniques in teaching problem solving.

The staff will develop the program in the fall of 1987, test it during the spring semester for a small group of participants, and use the information gained during an intensive three-week summer session for which participants will receive four graduate credits. Five participants will be Visiting Adjunct Lecturers.

Approximately one-half of the project activities will take place at the Fireboat House Environmental Center, a research center for the study of energy conservation and analysis of environmental problems. One-half of the activities will be held in the science education laboratory at Hunter College.

Hunter College CUNY has been designated as a minority institution, with more than one-half of its student body being black or hispanic. It has a deep commitment to teacher education and close rapport with the New York City public schools built on numerous joint projects. There is a unique cooperation between the education division and the division of science.

COLLEGE SCIENCE INSTRUMENTATION

Rivka Rudner	USE 8750842
CUNY Hunter College	FY87 $45,150
New York, NY	Biology

"Equipping an Undergraduate Instructional Laboratory with the Tools of the Molecular Biologist"

Recent advances in Molecular Biology and Molecular Genetics are significantly changing the laboratory approaches required for training undergraduates majoring in Biology. The Hunter College faculty has prepared a revised and expanded one-year Molecular Biology course for undergraduate majors which includes two updated laboratory courses in the areas of Biochemistry and Molecular Genetics. The revised and expanded curriculum (emphasizing basic cloning techniques, analysis of the plasmids present in recombinant clones, isolation and characterization of enzymes, and structural analysis of cell surfaces) will give students increased hands-on laboratory experience with molecular procedures and scientific instruments. In addition, increased access to the course for students with limited experience in the tools of scientific investigation will be possible.

For the experienced students there is opportunity to expand their existing knowledge by using modern molecular techniques for an independent honors research project. Additional changes in the two laboratory courses are also projected with the utilization of this same equipment. The major items being used to implement these changes include high speed ultra- and micro-centrifuges, a scintillation counter, shaker incubator and a speed-vac system. A large fraction of the students benefitting from these courses are women and/or members of minority groups underrepresented in the Nation's pool of scientists.

COLLEGE SCIENCE INSTRUMENTATION

Alan H. Strahler	USE 8750866
CUNY Hunter College	FY87 $50,000
New York, NY	Geology

"Undergraduate Laboratory for Remote Sensing, Digital Image Processing, Automated Cartography and Geographic Information Systems"

This project involves the establishment of a laboratory at Hunter College, part of the City University of New York, within the department of Geology and Geography. The project will integrate an existing program in remote sensing and image processing with related new and existing classes in geographic information systems and analytical cartography. This goal will be achieved by the establishment of a new laboratory containing four IBM-PC AT-based Earth Resources Data Analysis Systems, with associated geographic data processing modules, and the PMAP geographic information system software. When integrated with existing and new department computer hardware and software, this facility will offer a state-of-the-art instructional environment for the laboratory component of three separate but related areas of undergraduate coursework. These courses will strengthen an existing undergraduate program in remote sensing by providing a common ground between remote sensing and image processing, analytical and computer cartography, and geographic information systems. The resulting specialization will provide students with advanced undergraduate training for geographic information processing, and will give them experience with a system which is becoming something of an industry standard.

RESEARCH IN TEACHING AND LEARNING

Shiela M. Strauss	MDR 8751900
Rena Subotnik	FY88 $65,921
CUNY Hunter College	FY89 $76,164
New York, NY	Mathematics

"Gender Differences in Behavior and Achievement: A True Experiment Involving Random Assignment to Single Sex and Coeducational Advanced Placement (BC) Calculus Classes"

Standardized test results indicate gender differences in mathematics achievement on the secondary level, with boys consistently outperforming their female peers. This study will focus on the talented mathematics student enrolled in Advanced Placement BC Calculus. Its objective will be to examine, by way of a true experiment, gender differences in classroom interaction patterns, student perceptions of themselves as learners of mathematics, and achievement in advanced high school mathematics. The uniqueness and import of the project lies in the random assignment of subjects to single-sex and coeducational classes following identical curriculum strategies and plans. From the investigation of differential effects of classroom social environments on adolescent males and females will come further elucidation of the aids and obstacles to successful mathematics learning. As a final outcome of the study, those insights will be translated into practical proposals for general use with students in advanced mathematics courses on the secondary level.

COLLEGE SCIENCE INSTRUMENTATION

Rodney L. Varley	USE 8750582
CUNY Hunter College	FY87 $16,777
New York, NY	Physics

"A New Computer Interfaced Undergraduate Physics Laboratory"

The Department of Physics and Astronomy at Hunter College will introduce a new laboratory for physics majors. Students taking this new laboratory will have had an already existing lecture course and laboratory in the fundamentals of electronics. The equipment purchases will allow physics majors access to microcomputers (personal computers) used to (1) control experiments and (2) collect data from probes placed in the experiment. The five experiments which will be used are in the areas of heat (thermodynamics), properties of magnetic materials, properties of repetitive or oscillatory motion (nonlinear harmonic motion). The students will also see how a computer collects data from an experiment through various kinds of probes which sense the temperature and other quantities in time. The digital computer cannot make continuous measurements of (for example) temperature as it changes with time but instead must measure the temperature at discrete but closely spaced time intervals. This process of digitizing is quite interesting in itself and the student will learn what conditions must be met so that the digitizing is done properly and the result is faithful to the phenomena measured.

The major equipment proposed for purchase are six Macintosh microcomputers, chosen for their ease of use by the student. Also, proposed for purchase are (1) the equipment to perform the experiments, (2) the probes that sense or collect the data from the experiment, and (3) the equipment which connects the signal from the experimental probe to the computer (the computer interface).

COLLEGE SCIENCE INSTRUMENTATION

Lawrence Kobilinsky	USE 8851684
CUNY John Jay Col Criminal Justice	FY88 $35,300
New York, NY	Chemistry

"Using Pyrolysis-GC-MS to Enhance Student's Knowledge of Modern Instrumental Microanalytical Techniques and Methods of Science Research"

Minority and disadvantaged students are learning microanalysis theory and techniques and modern scientific research methods. Objectives include: integrating a gas chromatograph - mass spectrometer (GC-MS) data system into a microscale organic laboratory; using GC-MS and pyrolysis for an instrumental analysis course; and developing two novel advanced courses on "Methods of Scientific Research." Innovative projects are being used in the use of antibodies for biochemical analysis using pyrolysis GC-MS and the analysis of samples by pyrolysis GC-MS. Lab writeups and videotapes of the new experiments and instrument use are being prepared. Mastery of microanalytical techniques, research methods and computer skills is increasing the successful program completion by these students.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Frank R. Pomilla	TPE 8651985
CUNY York College	FY87 $265,084
Jamaica, NY	FY88 $253,874
	FY89 $285,467
	Multidisciplinary

"Project Leadership"

This project provides current and relevant content and methodology to 200 science and mathematics teachers in the 22 high schools of Queens County, New York City over the next three years. The 200 teachers involved directly will, in turn, serve as leaders in the enhancement of their colleagues in subject matter and classroom instructional strategies and methods. 60 mathematics, 60 biology, 40 chemistry, 20 physics, and 20 earth science teachers will be the direct beneficiaries of the program during the time of the project. These teachers will then work with the 550 remaining science and mathematics teachers in the Queens County high schools.

The project activities include 4-week summer institutes in 3 of the subject areas each summer, 6 follow-up workshops during the academic year, inservice activities at the high schools by the participating teachers, and periodic visits, collaboration, and consultations among the project faculty, participating teachers, and their peers. A Science Resource Center will be developed at York College during the term of the project and serve as a means of continuing the project activities once NSF funding ceases.

A thorough needs assessment was completed prior to the submission of the proposal. The personnel involved included a representative sampling of the client population who expressed a felt need for the content and methodology update because of the new Regents science and mathematics curricula, which are to be implemented in the immediate future. In addition, several teachers who have not participated in such renewal activities for several years will participate in this one.

INFORMAL SCIENCE EDUCATION

David R. Loxton MDR 8652302
Geoffrey Haines-Stiles FY87 $200,000
Educational Broadcasting Corp FY88 $200,000
New York, NY Broadcasting

"Childhood"

WNET/Thirteen will produce a series of 10 one-hour public television programs, "CHILDHOOD", that will explore how children grow and develop, and how parents and societies have raised children throughout history and across cultures. Extensive use of current research and scholarships from the disciplines of developmental and cognitive psychology, anthropology and sociology, education, history and culture will be used to create a coherent and revealing view of childhood development.

The series will be heavily promoted on public television, will be accompanied by a trade book and viewer's guide, and should generate audiences of more than 10 million viewers in its first series airing, based on the results of the producers' prior series, "The Brain"; the accompanying trade book sold more than 150,000 copies.

The producers of this series are highly skilled at the interpretation of complex scientific subjects on television, with a number of award-winning series to their credit. They have assembled a prestigious international team of advisors and consultants. Additional funding of $7.5 million is anticipated from the PBS/CPB Superfund, corporations, and co-production agreements.

INFORMAL SCIENCE EDUCATION

William Miles MDR 8751415
Educational Broadcasting Corp FY88 $202,634
New York, NY Broadcasting

"Black Stars in Orbit"

William Miles, an award-winning Black documentary filmmaker, will collaborate with WNET, New York to produce "Black Stars In Orbit," an hour-long television documentary for PBS broadcast on black astronauts and black Americans' contributions to America's space program. The program will utilize personal interviews with archival footage, family photographs, and news headlines to profile such individuals as Edward Dwight, Jr., Guion Bluford, Jr., Ronald McNair, Frederick Gregory, Patricia Cowings-Johnson and Robert Shurney. Videotape copies of the program will be made available for use by national organizations concerned with encouraging black youth in science and engineering. This film project has a substantial opportunity to reinforce science and engineering role models for black youth. Approximately 50% of the $450,000 project budget will be provided by NSF.

INFORMAL SCIENCE EDUCATION

George Page MDR 8550540
Richard Hutton FY85 $ 50,000
Educational Broadcasting Corp FY86 $300,000
New York, NY FY87 $530,000
FY88 $320,000
Broadcasting

"BRAIN II: A Television Series"

In 1984 the 300 member stations of the Public Broadcasting Service aired a series of eight one-hour documentary science television programs entitled "The Brain." Accompanied by a textbook, credit courses in colleges and high schools across the nation, and a popular book for the general public, the series was extremely successful. The series was funded by contributions from NSF, three of the National Institutes of Health, two private foundations and co-produced with France and Japan. The series has received both the Peabody Award and The Alfred I. DuPont- Columbia University Award for excellence in journalism.

This new project will develop a second and related series of nine programs that will extrapolate from the content, popularity and interest in the first series, to discuss much broader topics such as behavior, intelligence, genetics, and endocrinology. Content research for this series is well under way in cooperation with an eminent group of scientific and medical advisors. Funding is planned to follow the same cooperative pattern as the earlier series.

The series, planned for airing in late 1987, will be accompanied by an extensive promotional campaign, college and high school curricula, a trade book and museum exhibit. Preliminary support from the Ciba-Geigy Foundation has underwritten the early planning and negotiations are proceeding for co-production with British, French and Japanese broadcasting systems.

COLLEGE SCIENCE INSTRUMENTATION

Pierre-Yves Bouthyette USE 8851864
Elmira College FY88 $20,781
Elmira, NY Biology

"Establishment of Subcellular Fractionation Capabilities for Undergraduate Coursework and Student Research"

The ultracentrifuge obtained through this project is enabling the Division of Natural Sciences to develop complete subcellular fractionation capabilities in order to upgrade the curriculum in Biochemistry and Molecular Biology, as well as to add important new options to the undergraduate research program. Experiments have been designed for the isolation of plasma membranes, tonoplast membranes and other subcellular fractions, of such proteins as the ATPase and of viruses, plasmids and nucleic acids that require the use of an ultracentrifuge.

These new experiments are being incorporated into the curriculum in order to take advantage of faculty expertise in this field; to enable students to perform advanced experiments involving the isolation of subcellular fractions, proteins and nucleic acids; to extend and integrate use of other equipment such as the High Performance Liquid Chromatograph (HPLC), liquid scintillation counter and gas chromatograph, and to provide students with practical experience in the growing number of areas in Biochemistry, Cellular and Molecular Biology that require advanced subcellular fractionation.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

INFORMAL SCIENCE EDUCATION

Gene Searchinger	MDR 8751208
George A. Miller	FY87 $182,572
Equinox Films Inc	FY88 $182,572
New York, NY	Broadcasting

"Four Films on Language"

The evolution of language, perhaps two hundred thousand years ago, led to our ability to think abstractly, invent logic, store and exchange ideas and to create culture. What language is, how it works and how it distinguishes us from others is the subject of a four part public television series produced by Equinox Films, Inc., New York, N.Y.

To examine language, the series will be filmed in laboratories and universities throughout the United States and on the streetcorners to capture the everyday life and language of Americans. Additionally, parts of the film will be shot in Japan, a sophisticated culture with a completely different language type from ours and in North Central Australia and Papua, New Guinea, where two exotic languages of special interest are spoken.

Language is so taken for granted that most of us do not question its nature. Most educated people are unaware even of the revolution that took place in the study of language about 30 years ago. The intriguing interplay between language as a grammatical system and, conversely, as a living, changing part of human expression is a complicated and fascinating journey.

INFORMAL SCIENCE EDUCATION

Ellen Wahl	MDR 8550555
Jane M. Quinn	FY85 $ 50,000
Girls Clubs of America Inc	FY86 $215,286
New York, NY	FY87 $236,848
	FY88 $314,700
	MidSch Science

"Operation S.M.A.R.T. (Science, Math and Relevant Technology) A National Program of Informal Education"

The Girls Clubs of America, Inc. (GCA) will develop a national informal education program in math, science, computers and technology for girls ages 11-14. GCA serves 200,000 girls and 15,000 boys each year through 240 affiliated Girls Clubs Centers across the country. Seventy-five percent of the participants are from low-income families and 44 percent are minority group members. For the past 40 years GCA has provided help and opportunity for girls to achieve their educational and career goals.

Operation S.M.A.R.T. was started because of the interest of clubs at the local level. Seven of these clubs in the Northeastern United States are developing model programs. The GCA will oversee the development of math, science and computer programs in these seven Clubs, train staff and replicate the programs in 85 percent of the Clubs across the United States.

The GCA has an excellent track record and has raised substantial funds in support of this project from a broad array of foundations and businesses. The project has several excellent features which include close cooperation with the local school system and involvement of participants' families. This is a critical age for girls, a group of youngsters which have not been reached consistently or effectively. The target population is a high priority for NSF.

INFORMAL SCIENCE EDUCATION

Ellen Wahl	MDR 8751791
Jane M. Quinn	FY88 $719,611
Girls Clubs of America Inc	HS Science/Math
New York, NY	

"Operation SMART High School Age Component"

The Girls Clubs of America (GCA) plans to develop over a three-year period informal science learning activities to increase the participation of women aged 14-18 in mathematics and science. These materials are part of an overall program, "Operation SMART," that is a major national commitment by the Girls Clubs of America to include science and mathematics education as a major component of GCA activities at all age levels. Prior projects have developed and implemented successful materials directed at elementary and middle school girls; the present project extends this effort into the critically important high school years.

The materials will be developed by project staff in association with developers at the Educational Development Center (EDC), and piloted and tested in four Girls Clubs sites, along with training chapters nationwide. A publisher will be identified for national distribution and sales of activity materials sets, and a book-length publication designed for use by education programs of other youth-serving organizations.

A partnership with the Business and Professional Women's Association (BPW/USA) and its 3400 local chapters and with the AAAS Linkages Project will create many non-Girls Club sites. Dissemination to other youth- serving organizations will be carried out through the National Collaboration for Youth. As a result, Operation SMART's high school age materials should reach several hundred thousand young women. Foundations and businesses will provide substantial additional project support; approximately 51% of the total $1.4 million project budget is requested from NSF.

COLLEGE SCIENCE INSTRUMENTATION

Richard C. Reed USE 8851622
Hartwick College FY88 $39,500
Oneonta, NY Chemistry

"Integration of Instrumental Methods into an Undergraduate Curriculum. Instrumental Analysis: It Isn't Just for Juniors Anymore"

The utilization of major instrumentation to solve chemical problems is usually reserved for a course in Instrumental Analysis given in the third year of an American Chemical Society (ACS) approved degree program. With increasing numbers of students opting for non-ACS approved Chemistry degrees, fewer students are completing a chemistry sequence that includes instrumental analysis. Yet, it is important that today's students be familiar with state-of-the-art technologies and their capabilities in the arena of chemical analysis. A program to incorporate a graded introduction to instrumentation through a) demonstrations for freshmen and non-science major courses, b) use of such equipment for structural analysis and purity determinations for Organic Chemistry courses, c) understanding of the instrumental design in instrumental analysis, and d) incorporation as a resource tool in Senior Research projects is being introduced. The program is being developed around the three major spectroscopic techniques - nuclear magnetic resonance spectroscopy, Fourier transform infrared spectroscopy and mass spectrometry. The purchase of the mass spectrometer is completing the integrated spectroscopy program.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Joel T. Kerlan USE 8750916
Hobart and William Smith Colleges FY87 $14,550
Geneva, NY Biology

"Growth Chambers for use in Laboratory Studies and Undergraduate Research"

Students are exploring the effects of varying environmental stimuli on plant and animal systems with the assistance of two new Conviron E15 Plant Growth Chambers acquired through this project. The controlled environmental chambers are complementing the Department's greenhouse and nature preserve in ways that improve the laboratories in five courses -- as well as expanding undergraduate research options. The chambers are making it possible to conduct experiments at the cellular, organismal and population level on the effects of varying temperature, light and humidity.

A new array of questions now can be asked in the undergraduate laboratory courses, the answers to which are providing students with a more complete understanding of how an organism functions in its native environment, and how abiotic factors affect the physiology and behavior of all living things.

COLLEGE SCIENCE INSTRUMENTATION

Patrick A. McGuire USE 8750766
Hobart and William Smith Colleges FY87 $6,523
Geneva, NY Economics

"Macroeconomic Model Building Workshop with Computer Support for Upper Level Quantitative Economics Courses"

The project's purpose is to obtain instrumentation to enhance the economics curriculum in the areas of quantitative analysis and macroeconomic modeling. The equipment will provide students the opportunity for "hands on" research experience in upper level departmental courses. The workshop will concentrate on macroeconomic model building with an emphasis on the HOWS II model, an econometric model of the U.S. economy developed in a macro policy workshop over the past few years. The workshop will be located in a specific space on campus and used exclusively by students and faculty involved in upper level economics courses with an emphasis on research oriented and/or model building efforts. The project will support the acquisition of computer equipment for use in the macroeconomic workshop that will continue through the entire academic year and extend through the summer months with a student/faculty research emphasis.

TEACHER ENHANCEMENT PROGRAM

David Knee	TPE 8550088
Hofstra University	FY86 $ 84,142
Hempstead, NY	FY87 $128,655
	FY88 $ 48,000
	Mathematics

"Teacher Training Institute at Hofstra"

This project will provide enhancement and professional development experiences for 20 exemplary high school mathematics teachers from the Nassau County, New York area. The overall goals of the multi-year project involve the updating and deepening of the participants' mathematical backgrounds and teaching methodologies, the networking of the participants, the conduct of in-service workshops by the participants in their home schools, the dissemination of project materials and results to nearby school systems, and the investigation of the modelistic approach within a carefully planned documentation, assessment and evaluation effort. The second year of the project will involve 40 additional exemplary teachers.

NETWORKS PROGRAM

Gilbert J. Lopez	TPE 8751366
Industrial Management Council	FY87 $139,747
Rochester, NY	FY88 $167,573
	FY89 $176,591
	Mathematics

"Promoting Successful Precollege Mathematics and Science Instruction"

This project will disseminate model programs directed at increasing the pool of minority students who pursue engineering, science and mathematics based college study. The basis of this dissemination will be the programs that have been developed by the members of the National Association of Precollege Directors (NAPD). This organization includes twenty-one independent programs which have been successful at guiding minority students into engineering and other technical areas and helping to assure that they have the mathematics and science skills necessary to succeed.

In order to bring these techniques and the NAPD type program model to a new and much wider audience, NAPD will produce a series of comprehensive manuals to serve as resources for communities interested in adapting such models to their areas. In addition, a three tiered system of training seminars will be implemented which will include: Interactive National Training Seminars for school system policy makers, Regional Training Seminars for Administrators and other education and community leaders, and Local Implementation Workshops for individual school system personnel and others who will be adapting the model to their own areas.

COLLEGE SCIENCE INSTRUMENTATION

Jerome S. Levkov	USE 8750953
Iona College	FY87 $26,546
New Rochelle, NY	Chemistry

"NMR Spectroscopy: Course Revision, Interfacing and Dissemination for Undergraduate Instruction"

In this project, Nuclear Magnetic Resonance Spectroscopy is being used by biology, biochemistry, and chemistry majors at Iona College as a qualitative and quantitative tool, and as a probe for making fundamental physical and chemical measurements to enhance understanding of the theoretical and practical applications of this method to undergraduate instruction. As an exercise in practical electronics, students interface a personal computer with the NMR spectrometer using general purpose, commercially available hardware and software.

COURSE AND CURRICULUM

Stephen R. Hilbert	USE 8814177
Eric Robinson	FY88 $50,193
Diane Schwartz	Mathematics
Stanley E. Seltzer	
Paul G. Glenn	
Ithaca College	
Ithaca, NY	

"Planning a Problems-Based Calculus Curriculum"

Mathematicians at Ithaca College plan to develop a problem-based mainstream Calculus curriculum. These complex problems will require a minimum of several weeks to solve. The structure of the problems will vary from "case study" to "open-ended". Groups of students working together will solve problems which develop essential parts of the calculus, and use calculator/computers where relevant.

In-depth interviews with twenty-five faculty members from accounting, biology, chemistry, economics, finance, management, politics, psychology, and physics will identify realistic problems.

Two experimental courses sections of Calculus I will be taught in the Fall of 1989. In the Spring of 1989, a one-day conference on the "Future of Calculus" will be held at Ithaca College.

Ithaca College will share 45% of the cost of the project.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

TEACHER ENHANCEMENT PROGRAM

Peter F. Seligmann TPE 8751682
Charles D. Spencer FY88 $394,378
Steven R. Thompson HS Science
Ithaca College
Ithaca, NY

"Enhancement of Secondary Science Laboratory Instruction"

This proposal describes a four-year program with the first three years funded by NSF and the fourth funded by the University and other outside sources. The primary objective is to improve instruction in secondary school science laboratories by using the computer as a tool either to analyze conventionally acquired data or to both acquire and analyze data. This dual role for the computer lends credibility to the acquisition of different skills in the disciplines of biology, chemistry, earth science and physics. Two teachers from each participating school will be selected to develop the strategies in each of these two instructional modes. This will be further enhanced by a series of school-site visits and sharing conferences. Each year, 30 well-prepared teachers will be selected to attend a three-week summer workshop, followed by the visits and conferences during the school year. Appropriate laboratory computer applications will be developed and refined, using both original and existing materials. The applications, including implementation and teaching strategies, as well as the workshop materials, will be disseminated nationally through presentations at professional meetings. An ongoing evaluation of materials, instructional strategies, and effectiveness in the classroom will enhance the potential for success. About 28% of the cost of this project is being shared by Ithaca College and the participating school districts. This will insure the implementation of the program in the schools and the continuation into year four. Additional private source funding is being sought for year four, but sufficient commitment is included to provide for the project as written.

TEACHER ENHANCEMENT PROGRAM

Madeleine J. Long TPE 8652328
Long Island Univ Brooklyn Campus FY87 $755,566
New York, NY Mathematics

"Fellows for the Advancement of Mathematics Education"

Fellows for the Advancement of Mathematics Education, FAME, organized under the direction of the Institute for the Advancement of Science at Long Island University, Brooklyn Campus, will train 45 outstanding and experienced middle school teachers (fellows) over a three year period in mathematics, mathematics education and leadership, who will then serve as school building leaders and developers of Mathematics Resource Teams. Each fellow will train ten novice teachers (inexperienced teachers or teachers with insufficient mathematical background), one of whom will be selected to participate in SSET (Scientific Specialization for Elementary Teachers), a mathematics and science training program in Years II and III. More than 450 novices, 75% of whom are minorities, and 15 SSET teachers will receive training. At the completion of FAME, fellows will be qualified to teach at the junior high school level in New York State and will be provided released time from teaching to train other teachers. In year II FAME will be disseminated to Florida at Miami University, to Texas Women's University, and to New Jersey at Trenton State College.

The anticipated outcomes of FAME's design will be: 1) A replicable interdisciplinary mathematics curriculum for middle school teachers;2) A functioning network of schools, universities and educational agencies; 3) Recruitment of bright youngsters, particularly minorities, for teaching;4) A model for providing mathematics expertise to middle schools. An evaluation is built into the project in order that the replicability of the model may be validated.

Long Island University has already established the Institute for the Advancement of Mathematics and Science which is directed by the PI. Because of SSET (TEI-8316798; $381,686), whose science courses have been institutionalized, the Science Division (including mathematics) is now actively involved in teacher training and offers content courses especially designed for teachers and other adult learners. LIU will fund the fourth year of SSET.

LIU has made a commitment of $551,863 to the project including the director's salary after year one. At the end of the funding period the program will be institutionalized. The school districts have committed $424,875. The Universities which will be used for dissemination have committed $122,100. Businesses have made commitments for mini-grants to be awarded to participants to fund proposals.

COLLEGE SCIENCE INSTRUMENTATION

Donald W. Rogers USE 8750827
Long Island Univ Brooklyn Campus FY87 $7,116
New York, NY Chemistry

"Microcomputer Interfacing and Microelectronics"

At Long Island University, Brooklyn Center, students in chemistry, biology, physics, science education and pharmacy are gaining added experience in constructing interfaces between laboratory instruments and microcomputers, through the recent acquisition of twelve state-of-the- art microcomputers together with appropriate monitors, printers, plotters, and interfacing breadboards. This is being accomplished in ongoing classes specifically devoted to such interfacing activities where students receive instruction in microcomputer interfacing and programming for controlling and gathering data from laboratory instruments.

YOUNG SCHOLARS

Joseph W. Morin	RCD 8850305
Long Island University	FY88 $6,362
New York, NY	FY89 $6,362
	Life Sciences

"Techniques in Molecular Biology"

This Young Scholars Project at Long Island University revolves around a course, Techniques in Molecular Biology, which is designed to expose 11th and 12th graders to the methodology used in Molecular Biology. The summer commuter class emphasizes student participation in basic experiments in Molecular Biology, including isolation of chromosomal and plasmid DNA, enzymatic modification of DNA, screening of recombinant DNA clones, electrophoresis, microcomputer-assisted analysis of data and electron microscopy of DNA. Laboratory experiments supplement lectures and discussions about the methodology employed, alternate techniques, data analysis, and application of the techniques to other disciplines. The course includes discussions of the ethical aspects of research in Molecular Biology as well as career opportunities and academic requirements for careers in Molecular Biology. The students visit other research institutions to discuss career opportunities with members of the Personnel Department. Follow-up activities include several after-school meetings per month during the academic year for discussion of assigned research papers and lectures by faculty on their own research.

COLLEGE SCIENCE INSTRUMENTATION

C. Stewart Slater	USE 8750858
Manhattan College	FY87 $21,504
Riverdale, NY	Chemical Eng

"Membrane Gas Separation Experiments for an Undergraduate Chemical Engineering Laboratory"

The area of gas stream separation and purification has been revolutionized in the past decade by the development of hollow-fiber membrane systems. These new technologies are rapidly replacing antiquated ones and are being incorporated into the modern areas of chemical engineering. Applications are found in gas recovery for: waste gas streams, landfill gases, etc. and for gas generation and purification for: ammonia and petrochemical production, food processing and storage, semi-conductor manufacturing and the medical/health care industry. The present Chemical Engineering curriculum at Manhattan College will be supplemented by providing instruction and laboratory experience in gas separation by membrane processes. This will be accomplished through current course supplement, new course development and the introduction of new laboratory experiments covering the fundamentals of membrane gas transport and the operation of a hollow fiber membrane gas separator. Experiments on the laboratory-scale membrane system will illustrate the concepts of the driving forces for separation of gaseous components, overall material and component balances, separation factors in mass transfer, and temperature and residence time effects on gas separation. After completion of the course and laboratory developments, the student will have gained both theoretical and working knowledge of membrane processes used for gas stream separation and purification.

FACULTY ENHANCEMENT PROGRAM

Louis Theodore	USE 8854143
Manhattan College	FY88 $62,575
Riverdale, NY	Engineering

"Undergraduate Faculty Seminar: Hazardous Waste Incineration"

Few practicing engineers and scientists, faculty, or students have a working understanding of the fundamentals and state-of-the-art knowledge of hazardous waste incineration. The objective of this seminar is to present a course and develop a problem workbook on hazardous waste incineration to address this need and resolve this technology gap. The course material will be drawn primarily from Theodore and Reynolds' 1987 Wiley-Interscience book "Introduction to Hazardous Waste Incineration." Problems and solutions in the workbook will be generated by an interdisciplinary team of engineering and applied science faculty. Topics include: regulatory considerations, stoichiometric and thermochemical calculations, incinerator design, ancillary equipment, dispersion calculations, computer software applications, and facilities design. The first draft of the problem workbook will be prepared during a two week summer seminar session in 1988. The 1988-89 academic year will provide an opportunity to classroom-test the effectiveness of the problems in the workbook. A three-day follow-up summer session in late June of 1989 is also scheduled to provide an opportunity to revise, update, and edit, the workbook, and finalize production and distribution plans for implementation in undergraduate engineering and applied science curricula.

In addition to the NSF funds, participants' institutions will contribute about 10% in travel costs to the operation of the project. The grantee institution will provide another 20% toward the operation of the project.

COLLEGE SCIENCE INSTRUMENTATION

Brian R. Shero	USE 8750282
Medaille College	FY87 $24,425
Buffalo, NY	Biology

"Equipping a Microscope Resource Center for Undergraduates"

The College is organizing a single laboratory into an all-purpose Microscope Resource Center housing all of the College's microscopes and related equipment, allowing for maximum utilization of equipment at the lowest cost to the College.

The center is serving the Animal Health Technology program as well as the Biology Department. A microvideo camera unit and the new microscopes themselves are aiding the introductory students through expanding their capability for viewing samples of special interest.

PRIVATE SECTOR PARTNERSHIPS

Robert Hatfield	TPE 8751391
Andrew L. Popp	FY88 $122,650
National Executive Service Corps	FY89 $148,350
New York, NY	HS Math/Sci

"Placement of Retired Professionals in Secondary Schools for Teaching Science and Mathematics"

Retired scientists and engineers will be recruited through scientific and professional societies to serve as volunteers in schools to support math/science teaching programs. The program will be carried out in cooperation with the Baltimore school system. Three teachers will be placed in each of four Baltimore schools after appropriate training and orientation. Under the guidance of school system personnel, they will be used in ways deemed most useful by the teachers and administrators. The program will run for the academic years 1988-89 and 1989-90. Performance of the volunteers will be carefully monitored and evaluated. On the basis of this evaluation, literature will be prepared for dissemination to schools, professional societies, and businesses outlining successful procedures which could be duplicated elsewhere.

Cost sharing by the NESC and the Baltimore School District will equal 115% of the NSF funding.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Stephanie G. Robinson	MDR 8851088
National Urban League	FY88 $179,616
New York, NY	FY89 $212,326
	FY90 $138,960
	Physical Science

"The National Urban League Preschool Science Collaborative"

The National Urban League (NUL) will form a Preschool Science Collaborative with Educational Equity Concepts, the Boston Children's Museum, American Association for the Advancement of Science and Association of Science Technology Centers to develop, field test, produce and disseminate physical science activities for preschool children and to provide training for parents and teachers of this age group.

Materials produced by the Collaborative will include a center-based science activities manual, activities booklet for use by parents and play spaces or corners for science explorations. A promotional videotape will be developed to highlight various parts of the training for parents and teachers and to promote the use of materials in all preschool centers. The materials will be field tested in twelve Urban League affiliates representing a broad cross section of participants.

The preschool program is a component of NUL's Education Initiative which is interested in improving science education for preschool children from low income or single family households. It will receive the benefits of all the support resources that are available through NUL.

COLLEGE SCIENCE INSTRUMENTATION

Matthew J. Temple	USE 8853194
Nazareth College of Rochester	FY88 $10,988
Rochester, NY	Biology

"Computerized Image Analysis of Biological Data in Undergraduate Instruction"

This project brings quantitative depth and rigor to students' visual data by installing three complementary systems: (1) a computerized image analyzer; (2) a color video camera and recorder; and (3) Nomarski optics to upgrade an existing phase- contrast microscope. This equipment, along with a fluorescence photomicroscope obtained through a NSF grant in 1985, enables the immediate introduction of image analysis into these laboratory courses: Cell Biology, Immunology, Genetics, Plant Biology, Biological Systems, Contemporary Biology for non-majors, and Senior Research.

Computerized image analysis enables students to accurately and rapidly measure the size, shape and density of microscopic and some macroscopic objects, to statistically analyze these data, and to incorporate images and statistics into a single computer-generated lab report. The project enables both upper- and lower-level Biology students to transform initial qualitative perceptions of visual data into statistically-supported conclusions.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

PRIVATE SECTOR PARTNERSHIPS

Vincent J. Cusimano	TPE 8851077
New York City Board of Education	FY89 $145,925
New York, NY	Physical Science

"Partnership in Technology for the Physical Sciences"

Ninth grade physical science modules will be developed and tested with the dual objectives of bringing new content into the subject and of involving students in computer usage in a way which will help prepare them for entry into today's computer-based job world. These modules will be developed under the supervision of New York Board of Education staff. The Board will share responsibility for computer expertise with IBM, for technical content with the New York Academy of Sciences and Columbia University School of Engineering, and for input from research on computer-aided learning with Hofstra University and Hunter College. Fourteen modules will be prepared, test-taught, revised as needed, and issued. Teachers in each borough will be given necessary training to allow the introduction of the modules into the regular curriculum. The modules will also be made available for dissemination outside the New York City system.

Cost sharing by the New York City Board of Education and IBM will total $195% of the NSF funding.

CAREER ACCESS OPPORTUNITIES

Peggy R. Cole	USE 8850666
New York Hall of Science	FY88 $84,140
Corona, NY	FY89 $85,000
	Other NEC

"The Explainer Career Ladder"

This model project is designed to encourage women, minorities and the disabled to enter careers in science and mathematics teaching at the precollege level. The project will establish a Career Ladder model which identifies critical high school and college entry points into secondary school science teaching careers for minorities, women and the disabled. The model includes recruiting, mentoring, training, and professional employment for the target population. The first activity is a high school internship component involving ten hours of internship each week for one semester for selected members of the target groups. The second activity is the College Explainer component in which, at the New York Hall of Science, local undergraduates from the target groups are prepared to: orient school groups, offer workshops and floor demonstrations to families and school groups, deliver outreach programs to school and community groups, and represent the Hall at national conferences and professional meetings. Explainers work for up to 20 hours a week. Explainers are selected for their interpersonal skills and ability to understand and communicate science. The Explainer role will provide opportunities for interaction with scientists and technologists, politicians, and people of all ages and walks of life. In the third activity, Explainers, in their junior year enroll in a formal academic program leading to certification as secondary science teachers. The Hall of Science, Queens College, area school districts, and the New York City Board of Education are collaborators in this activity. In the fourth activity students, upon graduation from the pre-service program, are eligible for secondary science teaching positions. The personnel division of the New York City Board of Education and local school districts will ensure employment in city schools.

INFORMAL SCIENCE EDUCATION

Alan J. Friedman	MDR 8550953
New York Hall of Science	FY86 $144,846
Corona, NY	FY87 $141,315
	FY88 $ 33,418
	Museums

"Improving the Effectiveness of Science-Technology Center Exhibits"

The New York Hall of Science will develop a major exhibition on quantum theory - one of the most important developments in physical science in this century and one which has not been significantly treated by science museums. This exhibition will be the first major museum program to introduce quantum theory and its applications to the public.

Elements of the exhibit will include models of the atom, the puzzle of light, applications of the theory, and, finally, the human story of the creation of a new theory. Numerous participatory exhibits will be developed in conjunction with the project so that visitors can learn by doing.

Formative evaluation will be an integral part of this exhibit. This technique has recently been adopted by museums as a way to test exhibit prototypes with museum visitors and then redesign as necessary. A workshop will be held for museum personnel and a guidebook, Improving Exhibits Through Formative Evaluation, will be produced.

This book will be the first complete description of the formative evaluation process and will be a valuable addition to the museum field.

INFORMAL SCIENCE EDUCATION

Samuel Taylor MDR 8751795
New York Hall of Science FY88 $379,428
Corona, NY Biology

"Development of Interactive Microbiology Exhibits"

The New York Hall of Science is the only major science center in the New York Metropolitan Area and serves a rapidly growing audience with both public and school-based programs and exhibits. Low income families and members of diverse minority communities are a major part of its target audience. The present award will support a major 3,000 square foot permanent exhibition on microbiology and microscopic organisms organized around themes of disease, its causes, prevention and cure, benign and beneficial microbial agents, and the nature of microscopic life. The exhibition will make extensive use of new microscopic display technologies for interactive exhibitry, with extensive formative evaluation and testing of principal exhibit components. Professional publications, an exhibit monograph and low cost videotapes will be used in national dissemination and a classroom kit based on the exhibit will be circulated widely throughout the New York Metropolitan area.

This innovative project will form a significant part of the permanent exhibits of this newly reorganized science center. NSF support will constitute approximately 28% of the $1.3 million total project cost.

APPLICATIONS OF ADVANCED TECHNOLOGY

Ludwig Braun MDR 8470340
New York Institute of Technology FY85 $305,132
Old Westbury, NY FY87 $221,650
Mathematics

"A Proposal to Develop Discovery-Learning Materials in Mathematics"

There is widespread agreement that mathematics education must be improved to provide understanding of mathematics to a broader spectrum of students. Considerable evidence has been accumulated to demonstrate the value of computers in education in general, and in discovery learning in particular. The purpose of the proposed project is to capitalize on this knowledge, and to bring the capability of modern microcomputers to bear in creating discovery learning environments in algebra, geometry, trigonometry, statistics, and the calculus in grades 7-12. The project will develop 30 courseware packages in these disciplines.

The proposed project includes a research component to evaluate the impact of this learning environment on students in a variety of school settings, and over the range of student abilities.

TEACHER ENHANCEMENT PROGRAM

Annette Berkovits TPE 8751468
New York Zoological Society FY88 $213,304
New York, NY Zoology

"Zoos for Effective Science Teaching: A Training Program for Middle and Secondary Level Science Teachers, Phase II"

In September, 1986 the New York Zoological Society, funded by NSF, initiated a program for 30 outstanding middle and secondary school science teachers from New York, New Jersey, and Connecticut. The program was entitled "Zoos for Effective Science" (Z.E.S.T.). The present proposal is a continuation of the program for two additional years.

Six-hour sessions, held on 8 Saturdays, January through March 1987, involve behind-the-scenes touring, animal observation and data-gathering activities, audio/visual programs and presentations by zoo staff on animal behavior, cooperative breeding and demographic management for zoo animals, and care of classroom animals. Segments are conducted on how to design innovative materials linking classroom curriculum with use of the Zoo and on assisting participants with peer-training techniques. Role-playing exercises are used to enhance the confidence of the teachers in peer training.

Participants receive a wide range of printed materials including WIZE (Wildlife Inquiry through Zoo Education) classroom kits: Diversity of Lifestyles and Survival Strategies. WIZE, the winner of several prestigious awards for excellence in science education, is a life science curriculum for grades 6 through 12 developed by the Bronx Zoo with major funding from the National Science Foundation.

Each participant will select a subject of special relevance to his or her science discipline and develop an instructional unit on the topic. The best of the instructional units will be reviewed for inclusion in a Z.E.S.T. Teachers Manual, which will be made available to science teachers in the tri-state area for use in conjunction with class visits to the Bronx Zoo.

The topics teachers chose to concentrate on and the materials they received in their Z.E.S.T. training also serve as the basis for peer training the teachers are expected to conduct in their own schools. Prior to the Z.E.S.T. program, administrators from the participants' schools attend a conference at the Zoo for an overview of the project. The importance of their support to the teachers, particularly in their efforts to train their peers, is also stressed.

This project has a number of features which justify its funding as a Teacher Enhancement Project. The following are the more significant: 1) it broadens the perceptions about zoos being educational; 2) it presents techniques and materials using animal exhibitions in conjunction with classroom instruction; and 3) it develops a model for use by zoos throughout the country.

Carl Mitcham	8721989
Polytechnic University	FY88 $43,463
Brooklyn, NY	Engineering

"Engineering Ethics Outside the United States"

The 1970s saw the first sustained and systematic studies of engineering ethics in the U.S. These studies have been successful in identifying problems and raising consciousness about the need for ethical deliberation and education among technical professionals. There is at least one aspect which has been neglected, however: investigation of parallel or related work in other countries. This project will break new ground by systematically inventorying and analyzing engineering ethics in other countries. The result will be an "Introduction to Engineering Ethics in Countries Other than the United States: An Analysis with Annotated Catalog and Bibliography." This scholarly survey will include a collection of engineering ethics codes or related documents, an overview and critical assessment of related discussions, comparisons with engineering ethics in the U.S., a list of relevant professional organizations and institutions, and an annotated bibliography of publications. Unlike all previous engineering ethics studies in English, it will emphasize foreign language works (but will provide English annotations). Two issues likely to be put forth for greater consideration by the technical and scholarly communities in North America are those related to the possibilities of a socialist- communitarian and a religious engineering ethics, in contrast to the predominantly individualist and secular versions of engineering ethics which currently prevail in the U.S.

This project will make a unique contribution to broadening our scholarly understanding of different cultural approaches to engineering ethics. The resulting document will be a resource for scholars and for classroom teaching.

This project is co-funded with the NSF Directorate for Biological and Behavioral Sciences.

COURSE AND CURRICULUM

William E. Boyce	USE 8814011
Bernard A. Fleishman	FY88 $50,000
George H. Handelman	Mathematics
Edith H. Luchins	
William L. Siegmann	
Rensselaer Polytechnic Institute	
Troy, NY	

"Calculus and the Computer: Innovative Teaching and Learning"

Applied mathematicians at Rensselaer Polytechnic Institute will develop a Calculus course sequence in which computer technology is used to equip students with powerful and versatile problem-solving tools in order to gain deeper understanding of the underlying mathematical concepts. Content will include numerical computation, sophisticated graphics, symbolic computation, relations between mathematics and natural world, and mathematical modeling.

During the summer of 1988 a team of mathematicians, a physicist, an electrical engineer and students will develop instructional materials to support the use of the computer in Calculus. These materials will be used in the following academic year in two or three pilot sections of the calculus sequence.

RPI is contributing $36,000 or 40% of the project.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

YOUNG SCHOLARS

Walter Eppenstein	RCD 8850071
Rensselaer Polytechnic Institute	FY88 $53,098
Troy, NY	FY89 $53,098
	Physics

"Research Participation for High School Students"

The seven-week summer program for 30 secondary school students consists of two parts. In Part I students spend 90 minutes per day attending lectures, discussions and experiments on topics outside of the high school or college curriculum. Three mini-courses will be offered: 1) Phenomena of Light and Color in the Open Air, 2) Frontiers in Astrophysics, and 3) Lasers and Holography. In Part II of the program participants work in ongoing research programs as junior members of research teams consisting of professors, graduate, undergraduate and high school students. During the last week of the program, all participants have the opportunity to discuss their work before the group.

FACULTY ENHANCEMENT

Gary E. Wnek — USE 8854151
James A. Moore — FY88 $85,554
Sonja Krause — Chemistry
Rensselaer Polytechnic Institute
Troy, NY

"Course in Polymer Chemistry for University Faculty"

Rensselaer Polytechnic Institute will operate a comprehensive course in polymer chemistry for university faculty who may wish eventually to teach this subject or to incorporate it into courses in analytical, organic, physical, or biochemistry. The approach aims to overcome much of the reluctance to consider polymer chemistry as an important aspect of undergraduate training in chemistry. The four-week course will be composed of lectures, lecture demonstrations, and laboratory experiments. In addition to preparing faculty to teach polymer chemistry comfortably and enthusiastically, the course will encourage faculty to consider supervising undergraduate research in polymer chemistry.

In addition to NSF funds, participants' institutions will contribute about 15% in travel costs toward the cost of the project.

COLLEGE SCIENCE INSTRUMENTATION

Lynn Fuller — USE 8852823
Rochester Institute of Tech — FY88 $41,076
Rochester, NY — Electrical Eng

"Thermal Design of Integrated Circuits"

This project allows students in the Microelectronics Program to apply thermal imaging to the design of integrated circuits.

The laboratory that supports this project includes a Mikron Thermal Tracer which students use to measure and display thermal performance of integrated circuits which have been designed and fabricated in the Microelectronics Laboratory. This activity permits students to gain practical insight into the design and fabrication problems associated with integrated circuits.

In addition to its primary use in the Microelectronics Lab, the thermal tracer system is used by mechanical engineering students in analyzing fluid and heat transfer systems.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Mark Kempski — USE 8852420
Rochester Institute of Tech — FY88 $29,499
Rochester, NY — Mechanical Eng

"Development of an Undergraduate Systems and Control Laboratory"

This project supports the development of an undergraduate dynamic systems and control laboratory to enhance the sequence of dynamics courses presently offered by the Department of Mechanical Engineering. The laboratory is composed of four workstations equipped with an HP 6253A dual DC power supply, HP 6825A DC powe supply/amplifier, motor control module, and digital oscilloscope. Each pair of workstations is serviced by digital and analog pen plotters, and a Wavetek Data Multimeter interfaced to an IBM PS/2-50 computer for data logging, analysis, and digital control capability. The instrumentation allows the student to perform parameter quantification experiments on diverse system attributes such as spring constants, dashpot damping coefficients, and the torque and generator constants of electric motors.

This award is being matched by an equal sum from the grantee.

FACULTY ENHANCEMENT

Jeffrey Lasky — USE 8854186
Rochester Institute of Tech — FY88 $117,207
Rochester, NY — FY89 $ 14,769
FY90 $ 14,769
Computer Science

"Undergraduate Faculty Development Workshop in Software Engineering"

Rochester Institute of Technology will operate a Faculty Development Workshop in Software Engineering for approximately 30 undergraduate faculty during the summer of 1988. Its objectives are (1) to broaden their awareness and understanding of software engineering and (2) to provide a forum where issues related to undergraduate instruction in software engineering can be presented and discussed. Workshop sessions will be conducted jointly by professors and industry participants. Staff from the Federally funded Software Engineering Institute will also participate. Ample laboratory time will be available for attendees to gain direct experience with new software engineering teaching and research tools. A two and one-half year computer conference dedicated to undergraduate instruction in software engineering will begin immediately after the Workshop. The significance of this project lies in the eventual increase in the numbers of undergraduate students who are able to receive effective and contemporary instruction in a field of vital national interest.

In addition to the NSF funds, participants' institutions will contribute about 15% in travel costs to the operation of the project.

COLLEGE SCIENCE INSTRUMENTATION

Ronald G. Matteson	USE 8851810
Rochester Institute of Tech	FY88 $38,465
Rochester, NY	Computer Science

"Digital Document Processing Laboratory System"

This project provides undergraduate students in Computer Engineering, Computer Science, and Electrical Engineering the opportunity to design, implement, and test the significant elements of office automation systems used to process documents in digital form. It provides the necessary equipment to augment a new digital image processing laboratory. Scanners, displays, printers, and array processors, working in conjunction with new and existing PC/AT-type computers, enable the students to capture, display, process, and print hard-copy data. This equipment is used primarily by students in a new undergraduate Computer Engineering concentration called Digital Document Processing. It also provides the Electrical Engineering students additional laboratory facilities in their digital signal processing concentration. Computer Science students use the instrumentation to provide laboratory experiences augmenting previous optional hardware courses.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Alan H. Nye	USE 8750703
Rochester Institute of Tech	FY87 $29,697
Rochester, NY	Mechanical Eng

"Development of an Undergraduate Laser Doppler Anemometry Laboratory"

The objective of this laboratory is to introduce laser doppler anemometry to students taking a laser engineering course and courses in fluid dynamics. Two laser doppler anemometer systems will be acquired, one operating in the tracker signal processing mode, the other operating in the counter signal processing mode. In addition, optics will be purchased to operate the anemometer in either the forward or back scatter mode. Experiments can thus be conducted in both air and water.

COLLEGE SCIENCE INSTRUMENTATION

Evelyn P. Rozanski	USE 8750705
Rochester Institute of Tech	FY87 $50,000
Rochester, NY	Computer Science

"A Workstation Environment for an Undergraduate Computer Graphics Sequence"

This project will set up a graphics laboratory of six Sun 3/110 workstations networked to support a sequence of undergraduate graphics courses. Included will be a new course to cover aspects of graphics such as three dimensional modeling, shading, animation, ray tracing, antialiasing, fractals, and manipulation of color look-up tables. The project will provide returning cooperative education students the opportunity to test skills and knowledge obtained through practical experience in the structured environment of a university laboratory.

COLLEGE SCIENCE INSTRUMENTATION

Daniel Lewicki	USE 8852971
Russell Sage Junior College	FY88 $5,611
Albany, NY	Chemistry

"Acquisition of a Recording Infrared Spectrophotometer for Organic Chemistry"

The acquisition of a recording Infrared (IR) Spectrophotometer is substantially improving the quality and quantity of Organic Chemistry instruction. Students majoring in the pre-professional programs in Chemistry, Biology, Environmental Science and Nutrition are having the opportunity to gain first hand experience with IR spectroscopy, an important tool in the modern Organic Chemistry laboratory. The technique is enabling students to collect information about and describe the molecular structure of known and unknown organic compounds, to analyze mixtures of closely related compounds, to determine the purity of products from synthetic reactions, and to detect, identify, and measure the concentration of short-lived intermediates. By using IR spectroscopy, students are comprehending more fully the importance of instruments at every stage of structure determination, from isolation and purification to final comparison with an authentic sample, and are becoming familiar with equipment that is normally encountered by sophomores in four-year colleges. The students are being better prepared for transfer to the four year schools.

The grantee is matching the award from non-Federal sources.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Victoria L. Chapman	MDR 8751829
Margo Crabtree	FY88 $293,825
Walter J. Koetke, Jr.	FY89 $304,747
John D. Lent	FY90 $554,621
Scholastic Inc	FY91 $231,514
New York, NY	Physics

"SuperScience: A Mass Media Program"

The Scholastic, Inc. Project, Super Science: A Mass Media Program, will launch two classroom science magazines, one for grades 1 - 3, another for grades 4 - 6, with a companion series of computer disks materials. Each will stress hands-on and inquiry activities that mix science with reading, math and social studies. The science and technology skills and know-how that students will need as consumers, workers, and citizens will be an important aspect in the development of the project. The student magazines will have teachers' guides and a special periodical for early grade teachers.

COLLEGE SCIENCE INSTRUMENTATION

Edward M. Crosson	USE 8750275
Siena College	FY87 $49,404
Loudonville, NY	Computer Science

"Computer Graphics Equipment to Enhance Undergraduate Curriculum"

This project will set up a computer graphics laboratory using the Tektronix color graphics workstations with additional computer display terminals. This updated laboratory will be able to support instruction in animation, use of color, three dimensional graphics and the use of graphics standards. The proposal equipment will allow enhancement of the curriculum through addition of new topics to the introductory course and the enhancement of student research in graphics through independent study projects.

COLLEGE SCIENCE INSTRUMENTATION

Russell Dubisch	USE 8750276
Siena College	FY87 $28,610
Loudonville, NY	Mathematics

"The Development of a Facility for Symbolically-Aided Instruction in Mathematics and Physics"

Siena College will undertake the development and implementation of a computer-assisted instructional system in mathematics and physics with high-level symbolic capabilities. The system will utilize a Micro VAX II with SMP, a programmable symbol-manipulation program which will enable student users to communicate with the computer at an algebraic level. Software development will be carried out by Siena's Software Engineering class, under supervision of the principal investigator and other involved faculty. The facility will be integrated into the general physics and introductory mathematics courses, and will be used secondarily by students in the advanced physics courses.

COLLEGE SCIENCE INSTRUMENTATION

Karen S. Quaal	USE 8750540
Siena College	FY87 $21,890
Loudonville, NY	Chemistry

"Modern IR and UV/VIS Spectrophotometry in the Undergraduate Chemistry Curriculum"

Infrared (IR) and ultraviolet-visible (UV/VIS) spectroscopy are crucial methods for the current understanding of chemical structure and reaction mechanisms. The use of two such spectrophotometers, recently acquired by the Chemistry Department at Siena College, is providing students with knowledge of the theoretical basis of these methods and experience with state-of-the-art techniques for data retrieval and analysis. Together with a data station which is shared by the two instruments, and selected software, the laboratory sections of all of the upper level chemistry courses are impacted by the use of this integrated system. These courses include Organic Chemistry, Physical Chemistry, Instrumental Methods, Synthesis and Characterization, and Independent Research.

COLLEGE SCIENCE INSTRUMENTATION

Lise D. Wilson	USE 8852776
Siena College	FY88 $19,518
Loudonville, NY	Biology

"Introduction of Molecular Genetics Techniques into the Undergraduate Curriculum"

The goal of this project is to introduce current techniques in Molecular Genetics into the undergraduate Biology curriculum. The equipment it provides is making it possible to offer a new laboratory course in Molecular Biology, as well as to improve the present Cell Biology, Microbiology, and General Biology course laboratories. Approximately 170 students per year, at all undergraduate levels, will be affected by these changes.

The new equipment includes a bacteriologic incubator and water bath shaker to culture bacteria for the isolation of plasmids; a CO2 incubator and laminar-flow clean benches for student work with tissue culture; microcentrifuges for DNA/RNA purification and concentration; horizontal agarose gel units and a DNA-detection camera system to separate and analyze the products of restriction enzyme digestions; a polyacrylamide slab gel unit to analyze the products of in vitro transcription reactions; fluorescence illuminators to detect the cell- surface expression of the product of a transferred gene; and an ultraflow freezer for the long-term preservation of the bacterial strains and cell lines used in the experiments described.

By acquainting students with the methodology involved in molecular cloning and gene expression, this project is enhancing their academic experience, increasing their awareness of the scientific process, and preparing them more fully for scientific careers. The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Susan J. Bender	USE 8750390
Skidmore College	FY87 $9,580
Saratoga Springs, NY	Anthropology

"Developing Archaeological Field Methods and Laboratory Analysis in Undergraduate Education and Research"

This project seeks to expand the scope of archaeological field and laboratory activities through the acquisition of key pieces of equipment. The goal of the proposal is twofold. The first is to enable students to work more efficiently both in the field (e.g., through magnetometer-based subsurface survey) and in the laboratory (e.g., through the application of a database management system). The second is to expand the range of analysis and data presentation in student research through the use of more sophisticated equipment (e.g., transit mapping, high power microscopy, and photographic recording).

COLLEGE SCIENCE INSTRUMENTATION

Sherilyn G. F. Smith	USE 8852897
Skidmore College	FY88 $7,704
Saratoga Springs, NY	Life Sciences

"Instrumentation to Improve Undergraduate Laboratory and Field Studies in Organismic Biology"

In the area of Organismic Biology, this Department offers courses ranging from Physiology to Genetics to Ecology. If students are to fully appreciate the scope of these topics, they must become actively engaged in laboratory and field studies using current techniques. The goal of this project is to incorporate an EGC controlled-environment chamber, a HACH spectrophotometer, a Sartorius top loading balance with computer interface capability (all for laboratory use), a HACH portable testing "laboratory" and a LICOR data logging system (for field use) into the Department's instructional program.

These instruments are significantly improving laboratory and field instruction in organismic biology, particularly in Physiology and Ecology, by allowing students to experience first-hand such concepts as the effects of temperature on physiological processes and on population growth rates, and the nature of nutrient dynamics in aquatic and terrestrial ecosystems. Students also benefit from seeing how up-to- date equipment and research techniques are applied to examining modern biological hypotheses. Courses at the introductory, intermediate and advanced levels are affected, as is the Senior Thesis Research program.

The grantee institution is matching the NSF award with equal sums obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Ira W. Geer	TPE 8470344
SUNY College at Brockport	FY85 $401,114
Brockport, NY	FY87 $ 12,000
	Atmospheric

"Everyday Weather: The Development of a New Teaching Method Based on the Use of Telecommunicated Current Weather Information"

The State University of New York College at Brockport, in cooperation with the United States Weather Service, will hold a five-day workshop for 16 master secondary science teachers who are experienced in-service teacher educators to update their use of materials developed at the NSF funded project "Everyday Weather: Development of a New Teaching Method Based on the Use of Telecommunicated Current Weather Information". This supplemental funding will enable the PI to proceed with the implementation of project developed materials.

TEACHER ENHANCEMENT PROGRAM

Ira W. Geer	TPE 8751692
Edward J. Kumar	FY88 $349,269
Robert J. McLean	Atmospheric
SUNY College at Brockport	
Brockport, NY	

"Everyday Weather Project: Increasing Weather Awareness Through the Classroom Use of the Public Media"

EVERYDAY WEATHER PROJECT: Increasing Weather Awareness Through the Classroom Use of The Public Media will develop and pilot test an innovative method for teaching weather in upper elementary/ middle school classrooms and establish a permanent weather education implementation and communications network. The State University of New York College at Brockport, in partnership with the U. S. National Weather Service, and cable television's The Weather Channel, and in cooperation with the national newspaper USA Today, the National Earth Science Teacher's Association, and the Commonwealth of Virginia Department of Education will help develop three teacher education modules and a group of master precollege teachers and supervisors of science to present the modules to groups of upper elementary and middle school teachers. The new teaching method is based on the study of weather from the perspective of the kinds of weather information available to the public by newspaper, television, and radio. An extensive pilot study will be conducted in an attempt to determine the efficacy of the teacher materials and strategies in teacher enhancement activities.

A permanent weather education implementation and communications network will be established within the National Earth Science Teachers Association.

This project is co-funded with the NSF Directorate for Geosciences.

FACULTY ENHANCEMENT PROGRAM

Robert S. Weinbeck	USE 8854192
Gregory P. Byrd	FY88 $56,677
SUNY College at Brockport	Atmospheric
Brockport, NY	

"Weather: Sensing, Analyzing, and Forecasting"

The State University of New York College at Brockport, in cooperation with the U.S. National Weather Service, will conduct an Undergraduate Faculty Enhancement Workshop for Teachers of Introductory Courses with Weather Content. The two week workshop will be held July 25 - August 5, 1988, at the National Weather Service Training Center in Kansas City, Missouri, for 25 selected undergraduate college instructors of weather- related introductory courses. The major purposes of the workshop are (a) to bring participants up-to-date on those technologies and techniques used in meteorology to detect, analyze, and forecast weather, and (b) to equip and encourage these teachers to use the latest in telecommunicated weather information and instructional materials in their classrooms.

In addition to the NSF funds, participants' institutions will contribute about 15% in travel costs to the operation of the project.

COLLEGE SCIENCE INSTRUMENTATION

Michael J. DeMarco	USE 8750443
SUNY College at Buffalo	FY87 $16,779
Buffalo, NY	Physics

"Videotape-Computer-Assisted Introductory Laboratory for Physics"

The Physics Department at SUNY College at Buffalo will develop a videotape-computer assisted laboratory in mechanics and wave motion for students in introductory physics. This novel laboratory experience (which involves videotaping physics laboratory experiments and "real world" experiments that cannot be directly performed in the classroom) will allow the student to gather data and to learn at his or her own rate in an interactive mode. The equipment consists of Macintosh computers, video cameras, and recorders. Students will make detailed measurements on successive video frames using the computer and analyze the motion which has been recorded. It is expected that this project will enable students to better appreciate and learn physics.

YOUNG SCHOLARS

Edwin A. Mirand	RCD 8755791
Arthur M. Michalek	FY88 $39,242
Craig R. Johnson	FY89 $39,242
SUNY College at Buffalo	Life Sciences
Buffalo, NY	

"Young Scholars Program - Summer Research Participation Program"

The Summer Research Participation Program for high school seniors is currently in its thirty-fifth year of operation at Roswell Park Memorial Institute (SUNY-Buffalo). The Institute is the oldest and one of the largest comprehensive cancer centers in the world. The objectives of the program are: 1) to teach each student functional scientific facts, principles and techniques employed in research; 2) to expose students to an active research environment; 3) to allow the students to witness scientific creativity; 4) to develop in each student the skills, habits and attitudes required by scientific investigators; 5) to further develop the students interest in science; and 6) to help the trainee in planning his/her academic career in science. The trainees fulfill these objectives by implementing a research project in a research laboratory under direct supervision of a senior investigator. The remaining time is spent attending formal lectures and seminars in specific areas of biology, chemistry and biophysics conducted at the Institute.

Projects are assigned to students by their senior investigator who serves as their summer mentor. The Education Department assists senior investigators in the selection of students to insure that the students' interests and the objectives of the program are fulfilled. A one-to- one relationship between senior investigator and student is sought to facilitate the learning process.

COLLEGE SCIENCE INSTRUMENTATION

Bonnie M. Sampsell USE 8750648
Douglas P. Easton FY87 $22,612
Hadar Isseroff Biology
Gary W. Pettibone
SUNY College at Buffalo
Buffalo, NY

"Improvement of Undergraduate Advanced Cell Biology and Recombinant DNA Technology Courses"

The equipment purchased through this award is being used to improve the laboratory components of two courses: Advanced Cell Biology and Recombinant DNA Technology. The courses are designed to present the fundamentals of experimental procedures and to provide opportunities for extensive practice with different pieces of equipment under the supervision of experienced researchers.

Among the competencies being developed are microscopy, spectrophotometry, electrophoresis of proteins and DNA, growth of bacteria, and the isolation and manipulation of recombinant DNA. Use of computer programs to analyze molecular structures also is being taught. A phase contrast microscope, two UV-VIS spectrophotometers, gel boxes and a power supply for electrophoresis, an incubator/shaker and a sterile hood for growing and handling bacteria, a computer and computer software -- all purchased with help from this grant -- are being used to illustrate current techniques commonly encountered in Molecular Biology. Students completing the two courses are learning habits and skills that they can use in graduate school or in an entry-level position in a research laboratory. Many graduates of the program will become science teachers at the pre-collegiate level.

COLLEGE SCIENCE INSTRUMENTATION

James R. Spotila USE 8750426
SUNY College at Buffalo FY87 $46,872
Buffalo, NY Ecology

"Improving an Undergraduate Interdisciplinary Aquatic Science Program on Lake Erie and the Niagara River"

An interdisciplinary program in aquatic science focused on the Great Lakes ecosystem is being improved by this project. Using a 37 ft. research vessel, smaller boats and a field station on 3.5 acres of land at the mouth of Lake Erie a group of faculty from the Biology and Geoscience, Physics and Interdisciplinary Science (GPIS) Departments are teaching undergraduates how to conduct modern scientific research on freshwater aquatic systems. Both formal course work and independent student research projects are involved. Scientific equipment acquired is being used for quantitative experiments in aquatic ecology, microbiology and sedimentology. Unique research and instructional opportunities are being provided for undergraduates and high school teachers. Major items of equipment include a portable photosynthesis system for measuring primary productivity of emergent aquatic plants, an epifluorescence microscope for enumerating aquatic microorganisms, and a SediGraph 5000ET for textural analysis of fine grained sediments.

TEACHER ENHANCEMENT PROGRAM

Bonnie B. Barr TPE 8652457
SUNY College at Cortland FY87 $100,514
Cortland, NY Elem Science

"A Development Program for K-6 Teachers in Multidisciplinary Science and Inquiry Skills"

This project develops an inquiry-oriented, quantitative science program in the elementary school and establishes a program by which peer teachers provide inservice guidance to other teachers. During the summer of 1987, five peer mentor teachers trained in a former NSF project will attend a one-week intensive leadership seminar on the SUNY/Cortland campus. The purpose of the seminar is to prepare the teachers to serve as consultants and facilitators of instruction for teachers from the five school districts participating in the 1987-89 project. A two-day workshop will also be held during the summer for five peer/mentor teachers, twenty K-6 teachers, ten junior/senior high school science teachers, and elementary principals from each of the five districts. The purpose of this workshop is to promote working relationships between peer/mentor teachers and staff of the districts.

During the 1987-88 school year the twenty K-6 teachers will participate in sixteen 2 1/2 hour instructional sessions which will be held every other week. During alternate weeks the project staff will visit each participant's classroom. The purpose of the staff visitation is to help these peer teachers implement the science content instruction and the methodologies into their classrooms.

During the implementation phase (academic 1988-87) the four teachers from each district will conduct inservice programs. During this phase the P.I. will make ten visits to each of the five schools. The visits will help facilitate implementation of the science program into all elementary classrooms of the districts.

Mini-grants, supported by local organizations, businesses, and industry, will be available to the participants to conduct a mini research project in their classrooms. A second unique feature of the program is a Make It/Take It Workshop during which classroom instructional materials will be constructed for use in the teachers' classrooms.

TEACHER ENHANCEMENT PROGRAM

Ram P. Chaturvedi	TPE 8751730
Richard M. Wheeler	FY88 $111,389
SUNY College at Cortland	Physics
Cortland, NY	

"Enrichment in Modern Physics"

Enrichment in Modern Physics is a two-year program for 24 high school physics teachers from the Central New York region. This project is designed to provide concentrated study in modern physics for underprepared teachers from rural school districts. In addition, teachers will receive training in pedagogical techniques that will permit them to introduce modern physics topics in their high school courses. During the first three-week summer workshop, participants will receive training in atomic physics, solid-state theory, conductivity, and semiconductor physics. During the second summer they will cover topics in gravitational physics, astronomy, nuclear physics, and quantum phenomena. Both summer workshops include laboratory components aimed at providing the participants with a number of inexpensive demonstrations and hands-on activities in modern physics which can be used in high school physics courses. Participants will become part of the SUNY, Cortland Physics Sharing Group, which provides continuing in-service support for physics teachers in the central New York region. This project has been designed as a model to address the urgent need to train teachers to include modern physics in the high school physics course.

The State University of New York at Cortland and several School Districts of Central New York have contributed an amount equal to 40% of the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Timothy Eckert	USE 8851903
Garon Smith	FY88 $18,904
SUNY College at Fredonia	Chemistry
Fredonia, NY	

"Fourier Transform Infrared Spectroscopy for Undergraduates"

A Fourier transform infrared spectrometer (FTIR) is being acquired for use in two areas of undergraduate instruction - structured laboratories and independent undergraduate research projects. Students at the Sophomore level are using the FTIR in microscale organic labs to perform quantitative analyses of products and to demonstrate organic reaction kinetics/mechanisms. Students in the Junior analytical laboratory sequence are assembling a network of interfaced instruments by combining the FTIR and its associated computer with a compatible spectrofluorometer. The students are using the FTIR to explore its ability to quantitatively analyze samples in a variety of physical states - aqueous solutions, dilute solutions, opaque solids, polymer coatings, etc. Students are using the networked spectrofluorometer to characterize a polynuclear aromatic hydrocarbon mixture with 3-dimensional fluoroscopy. Students in the extensive undergraduate research program are able to select from eight, FTIR-oriented research projects that have been designed by five faculty members (3 inorganic, 3 analytical/ environmental, 1 organic, 1 polymer).

The grantee is matching the award from non-Federal sources.

FACULTY ENHANCEMENT

Janet Lanza	USE 8854270
Jimmy D. Winter	FY88 $44,407
Thomas A. Storch	Ecology
SUNY College at Fredonia	
Fredonia, NY	

"A Workshop in Quantitative and Analytical Ecology for Faculty"

This project will provide 12 undergraduate faculty with hands-on experience in three areas of ecology: 1) experimental assessment of pollinator responses to amino acids in nectars; 2) telemetric monitoring in ecology; and 3) control of nitrogen fixation in aquatic microorganisms. Participants will be given appropriate reading materials and laboratory methods devised by the project directors. Methods of instruction will include lectures and discussions but will primarily depend on field and laboratory work with the project directors. Associated with the studies in these areas, participants will learn to devise hypotheses, conduct experiments, and analyze and present the resulting data. They will use computers for data analysis and presentation and will learn to make 35 mm slides for oral presentations. Finally, they will develop laboratory exercises for their own courses and may be able to initiate new undergraduate research projects with their own students. After using and evaluating at least one of the laboratory exercises in a course, they will share their results with the other members of the group.

In addition to the NSF funds, participants' institutions will contribute about 15% in travel costs, and the grantee institution will contribute about 10% in additional operating costs.

COLLEGE SCIENCE INSTRUMENTATION

B. L. Redmond USE 8750376
SUNY College at New Paltz FY87 $46,775
New Paltz, NY Multidisciplinary

"Upgrading an Interdisciplinary Electron Microscopy Facility for Undergraduates"

SUNY College at New Paltz will improve an undergraduate electron microscopy program for the Departments of Biology, Chemistry, Geology, and Physics, as well as a newly organized School of Engineering. The college will purchase a Scanning Electron Microscope (SEM), model JSM- 840 manufactured by JEOL. The primary application of the SEM will be to shift from the old, descriptive, morphological applications to current, quantitative, analytical uses of the SEM. This will impact on 1) E.M. courses for science and engineering majors; 2) the undergraduate research program; 3) programs for non-majors, specifically, the general education program; and 4) community outreach to other colleges, community colleges and high schools. This project will upgrade a program in electron microscopy, and provide undergraduate science, engineering and science education majors with the necessary technical background and analytical skills to be competitive for graduate programs at major universities or to go directly into the scientific workforce in science, medicine, industry or public education.

YOUNG SCHOLARS

Jong P. Lee RCD 8850097
Maureen Dolan FY88 $35,848
SUNY College at Old Westbury FY89 $35,848
Old Westbury, NY Mathematics

"Long Island Mathematics Enrichment Institute for High Ability or High Potential Young Women"

The State University of New York/College at Old Westbury conducts a two-year project to create the Long Island Mathematics Enrichment Institute for High Ability or High Potential Young Women, in collaboration with the Nassau County Mathematics Association, the Suffolk County Mathematics Association, and the Nassau County Mathematics Supervision Association. For each of two fifteen-Saturday morning cycles Old Westbury works with twenty-five 10th or 11th grade students. During the academic year, students participate in career awareness sessions, consciousness-raising efforts, role model lectures, motivational workshops and specialized mathematics instruction. Attendees undergo sixty hours of academic-year project activities, and 12 hours of summer follow-up.

Participants share Institute training and motivation with classmates in school districts. Videotaping of workshops/seminars afford teachers the opportunity of viewing presentations with nonparticipating students. A "how to" replication manual after Year II will be available for national replicability. Four hands-on, research-oriented field visits / demonstrations during high school intersession breaks will complement academic-year efforts. Parental involvement in workshops, a mentoring component and career planning sessions add a necessary dimension to Institute design.

COLLEGE SCIENCE INSTRUMENTATION

Currie D. Marr USE 8750023
SUNY College at Oneonta FY87 $11,160
Oneonta, NY Biology

"Plant Growth Chambers for Undergraduate Laboratories"

Ten Botany courses in the Biology curriculum share a common need for environmental growth chambers where factors of light, temperature, and relative humidity can be regulated to observe their effects on plant growth and behavior. The wide range of biological phenomena being investigated using the two new PT-80 Percival Growth Chambers include the initiation of the sexual phase in algae and bryophytes, the study of physiological processes in various groups of plants, developmental differentiation in plant organs and in callus tissue, and the effects of environmental factors on growth, survival and competition in populations of native plants. The growth chambers also are being utilized in the study of ectomycorrhizae by General Mycology students, and in conducting tissue culture experiments in Plant Growth and Development and Biotechnology courses.

TEACHER PREPARATION PROGRAM

J.Nathan Swift TPE 8470215
C. Thomas Gooding FY85 $360,280
SUNY College at Oswego FY87 $142,410
Oswego, NY Chemistry

"Increasing the Effectiveness of Biology and Chemistry Instruction Through Research Applications"

Work by the principal investigators indicates that significant advances in teaching and learning can be attained within the existing structure of schools. Pilot research studies on wait-time feedback and on subject-specific, supportive intervention have yielded positive statistical changes in teacher behavior. The current project is conducting a systematic investigation using an experimental design to test the significance of these two strategies in achieving the following outcomes: (1) increasing student involvement; (2) increasing interaction and improving student attitudes in the classroom; (3) increasing student achievement in biology and chemistry; (4) increasing elective enrollments in science; and (5) enhancing teacher job satisfaction. The project will also disseminate content and teaching practices that enhance instruction and will instruct master teachers and team leaders in techniques promoting professional development.

This project will develop knowledge about effective teaching in science and result in more effective methods for teacher education.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Peter G. Weber MDR 8470180
Donald D. Cox FY85 $111,330
Alfred J. Stamm FY86 $ 93,485
J. Nathan Swift FY87 $ 89,733
Suzanne P. Weber Biology
SUNY College at Oswego
Oswego, NY

"Winter Ecology Curriculum Development: A Neglected Aspect of Precollege Environmental Science Education"

In secondary schools located in the northern parts of the United States, instruction in ecology and on related topics in biology and earth science can be enhanced by placing more emphasis on winter activities. Winter activities that are readily available on or near school grounds can be used effectively to teach ecological concepts and principles wherever snow, ice, and cold persist during winter.

This project will bring together a team of college scientists and secondary school science teachers to collaborate on the development of instructional materials in winter ecology. The products of this project will be a packet of field and laboratory exercises suitable for use in middle and high school science classes and a teacher's guide containing winter ecology background materials and preparatory information for the field and classroom activities. Both the packet of student materials and the teacher's guide will be prepared in a looseleaf format to enable teachers to use selected exercises conveniently and at minimal cost. The student materials will be easily reproducible.

COLLEGE SCIENCE INSTRUMENTATION

John W. McCormick USE 8852686
SUNY College at Plattsburgh FY88 $41,711
Plattsburgh, NY Computer Science

"Distributed Processing and Computer Control"

This project provides students with training in real-time computer control using a hardware/software environment that supports concurrency and distributed processing.

The programming training received by most Computer Science undergraduates does not lend itself to application to real-time control of complicated systems. Curricula are changing to meet the need for programmers who can function in a systems control environment. However, too frequently students must be satisfied with learning about theoretical models without seeing those models applied to real problems. Also, many theoretical models gloss over some practical issues having to do with the control environment.

This project not only exposes students to state-of-the-art software development tools for real-time systems control, but it also provides them with a flexible physical test-bed for their programs.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

James F. Olmsted USE 8853026
SUNY College at Plattsburgh FY88 $13,872
Plattsburgh, NY Geology

"Automation and Modernization of an X-Ray Diffractometer for Undergraduate Environmental Geology and Hydrology"

The grantee institution will purchase equipment and software to automate and upgrade an existing manual X-Ray Diffractometer. A microprocessor controller, diffracted beam monochrometer, microcomputer, control and data collection software, minerals database, and search/match software will permit fully automated collection and analysis of X-ray data. The upgraded facility will be used to improve instruction in courses in X-Ray Crystallography, X-Ray Analysis, Water Quality Analysis, and Soil Analysis. In addition, the upgraded X-Ray Diffractometer will be used by undergraduate students in independent research projects.

The grantee will match the NSF award with an equal amount of funds.

TEACHER PREPARATION PROGRAM

Leland Manske TPE 8652068
SUNY College at Potsdam FY 86 $167,649
Potsdam, NY FY 87 $162,940
FY 88 $177,790
FY 90 $171,059
FY 91 $159,467
MidSch Math/Sci

"NSF Middle School Math and Science Education Program at Potsdam College"

Potsdam College, a regional state teacher preparation institution, proposes to develop a model program to prepare middle school teachers in both science and mathematics. The program will consist of 36 semester hours in science, 21 in mathematics, and 24 in professional education with a two-semester teaching internship. The programs goals are to provide teachers with breadth and depth of understanding of science and mathematics; an understanding of the interrelationships among scientific and mathematical disciplines; and an appreciation of the relevance of science and mathematics to society and to the lives and concerns of middle school students. Teams of scientists, mathematicians, educators, and master middle school teachers will design the new curriculum. The science courses, progressing in sophistication and conceptual depth, will integrate the fundamental concepts of biology, physics, chemistry, and geology. Students leaving the program after two years will receive credit for the introductory year in each science area. The mathematics minor, coordinated with the science major, consists of four modified courses and three new ones. The new courses will focus on applying mathematics and the integration of topics from the previous courses. The computer will be part of all courses; PASCAL will be introduced in the last mathematics course. The existing professional education courses will be adapted to the needs of middle school teachers and the two methods courses will be co-taught by college faculty and a master middle school teacher. During the professional or final year of the program, students will teach two classes during the first semester in classrooms of the master teachers and carry a full teaching load the second semester. The program will be carefully evaluated and its effectiveness widely shared.

COLLEGE SCIENCE INSTRUMENTATION

Joseph R. Cristina, Jr. USE 8852002
SUNY Erie Community College FY88 $50,208
Williamsville, NY Mechanical Eng

"Acquisition of Computer Aided Drafting (CAD) Equipment"

The Civil Engineering Technology Unit at this institution is acquiring new hardware and software for their Computer Aided Drafting (CAD) Laboratory to teach a generic approach to CAD. The special objective of this project is to teach disabled students, with limited mobility, the necessary drafting skills required in conventional drafting courses. In equipping the laboratory with 16 workstations consisting of an IBM PS/2 Model 50 computer, a color display monitor, a graphics tablet and mouse, AUTOCAD software and access to an HP Plotter, the disabled students are offered training on an advanced, industrial CAD system. The success of this project will potentially create new educational opportunities for the disabled.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Evelyn Stephens USE 8852778
SUNY Fashion Institute of Tech FY88 $22,125
New York, NY Physics

"Color and Light: Education in Applied Physics at the Fashion Institute of Technology"

This project will upgrade and expand instruction in color science in nine associate and baccalaureate degree programs at the Fashion Institute of Technology (F.I.T.). F.I.T. is a specialized community college of the State University of New York. The understanding of color in scientific terms is an essential part of the professional education of a growing number of full and part-time students at F.I.T. who prepare for careers in fashion and its related industries and professions. Beyond the need for professionally relevant education, the college is committed to the importance of providing hands-on experimentation in up-to-date laboratories to enable a wide variety of students to understand, first-hand, the rigors, creativity, and excitement of modern scientific inquiry. The acquisition of a computer-driven spectrophotometer with appropriate software and plotter, portable colorimeters, and dyeing equipment will upgrade laboratory instruction, reducing student frustration with failure of old equipment and increasing the range of experiments students will perform. This project will strengthen the F.I.T. model of integrating professional education with relevant instruction in basic sciences, mathematics, and liberal arts.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Max Dresden TPE 8470163
SUNY Stony Brook FY84 $506,860
Stony Brook, NY FY87 $ 73,534
Other NEC

"Project For the Integration of Advanced Research and Teaching in Science and Mathematics"

"The Integration of Advanced Research and Teaching Science and Mathematics" will have two fourteen-day sessions in the summer of 1988 in each of which fifteen participants, who have attended previous summer sessions, will write materials for teacher enhancement based on information gained in the program. The principal investigator, Max Dresden will edit, collate and polish this material in order to produce a monograph assisted by five teachers who will attend both summer sessions. This monograph will then be scrutinized and evaluated by high school teachers who have not been involved in the project. The final monograph will include a general introduction; the content of lectures, as well as discussions, given during the project; and detailed suggestions that individual teachers might employ to provide a current status report on selected topics of contemporary science to their students.

This monograph, written by teachers, will complete the goals of the original project and make available a concrete contribution to the craft of science teaching.

Robert L. Lichter	RCD 8751437
SUNY Stony Brook	FY87 $15,000
Stony Brook, NY	Recruitment

"National Workshop on the Role of the Faculty in Meeting the National Need for African-American, Latino, and American Indian Scholars"

The primary goal of this workshop is to delineate the role of graduate university faculty in increasing the number of minority scholars. The impetus is the status in minority enrollment in graduate school. Faculty members play a pivotal role in producing scholars through recruitment, financial aid, mentoring and guidance, all essential to academic success.

The vehicle is a national invitational workshop where specific courses of action will be identified by 75-100 participants representing academia, industry and government. Proceeding will be widely publicized and outcomes will be assessed. A national advisory committee will aid in the implementation of workshop recommendations.

The focus on faculty roles is timely and the planned follow-up activities are unique and should aid in the distribution and implementation of findings.

COLLEGE SCIENCE INSTRUMENTATION

Theodore J. Skaar	USE 8851930
SUNY Ulster County Comm Col	FY88 $32,500
Stone Ridge, NY	Geology

"Introduction of Inductively Coupled Plasma Technology to a Community College Water Quality Monitoring Program"

The grantee will purchase an inductively coupled plasma spectrometer and automatic sample changer. This equipment will be used to improve instruction in the water quality monitoring program. Students who are training to become water quality monitoring technicians will be introduced to the type of instrumentation that now is used by commercial and governmental laboratories to monitor for trace pollutants in water supplies.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Dennis P. Swauger	USE 8851801
SUNY Ulster County Comm Col	FY88 $33,639
Stone Ridge, NY	Chemistry

"Computerization of the General Chemistry Laboratory at Ulster County Community College"

Microcomputers are being interfaced with laboratory instruments in the General Chemistry program. Student involvement is being maximized in the process of measurement, data acquisition, and data analysis. The efficiency and precision of laboratory measurements is being increased, as well as the student interest and understanding of the nature of the measurements and the principles of Chemistry that the laboratories are designed to illustrate. Four data acquisition devices, eight microcomputers directly connected to the devices, a hard disk drive and tape backup for software and data storage as well as a fileserver system are included. Each data acquisition device serves two student workstations. The workstations were completed with the purchase of: eight digital balances for routine mass measurements, three bomb calorimeter systems for calorimetric studies of foods and fuels, two spectrometers for routine quantitative analyses as well as equilibrium and kinetic studies, four pressure transducer systems and eight thermistor thermometer systems for temperature measurements.

The grantee is matching the award from non-Federal funds.

RESEARCH IN TEACHING AND LEARNING

Herbert P. Ginsburg	MDR 8751665
Janine Bempechat	FY88 $110,724
Teachers College	FY89 $114,333
New York, NY	Studies

"Cultural Differences in the Socialization of Achievement"

This project will examine the degree to which the socialization practices of Asian American parents foster motivational and attitudinal tendencies that contribute to high achievement in mathematics and science in their children. In five studies, spanning grades 2-12, Asians are directly contrasted with Caucasians in similar environments on background, attitudes, and achievement, with due attention to socioeconomic and immigration related influences.

The researchers have previously developed questionnaires to measure both home rearing experiences and naive theories of education. Predicted findings are that by mid-childhood, Asians will demonstrate precociousness for realism of self-evaluation and awareness of their ability as compared to their peers. In the pubertal period the prediction is that Asians will show a greater prevalence of adaptive beliefs and a lower incidence of helplessness. In adolescence the prediction is that as a concomitance of attributional differences, there is a more mature pattern of time perspective, sensation seeking, and the perception of tasks as contingent for success. Throughout the project, objective indices of achievement will be used to evaluate how much of within-group variance is accounted for by the sociological constructs. In making recommendations the investigators will be sensitive to the need to neither homogenize descriptions of Asians nor overlook negative costs of socialization such as incidence of adolescent anxiety and depression.

A hope of this project, in view of the under-achievement in American schools in technologically relevant education, is to identify a set of child rearing practices which will help every child make the most of educational resources. These child rearing practices should be adaptable by individual parents and worthy of attention by community leaders among the disadvantaged. The ultimate aim of the project is to suggest a foundation for intervention in the social situations which produce failure.

STUDIES AND ANALYSES

Willard J. Jacobson	OSPA 8470382
Teachers College	FY85 $358,857
New York, NY	FY86 $384,739
	FY87 $358,857
	FY88 $124,500
	Studies

"Second Phase, International Science Study"

This is to provide continuing support for a three-year project conducted by Columbia Teachers College. In 1983, 25 countries joined the U.S. in an international survey of science achievement. Columbia University is now augmenting the 1983 U.S. survey with a survey of achievement in science process skills and content, student and teacher characteristics, and factors in the school environment that may affect science learning in representative samples of American schools. Science process skills and science achievement will be surveyed in grades 5 and 9. Surveys of science achievement will be made for biology in the 10th grade, chemistry in the 11th grade, and for each of the science subjects for advance science students. Students, science teachers, and school administrators in the schools in the samples will respond to questionnaires dealing with science and science achievement in their schools. The responses will be used in the search for factors associated with science achievement. The study will be carried out in an international context with similar data available for Japan, Israel, Hungary, Singapore, Korea, and Hong Kong. International data will be used in analyses, and comparisons will be made with results of similar studies in 1970 and 1983. The study should be of special value to teachers and science education policymakers at the local, state, and national levels.

The FY88 grant is a supplement to conduct the U.S. portion of this large-scale international survey of science education. Data have recently become available for 10 or 11 countries, including the U.S. This supplement will support the data editing, statistical weighting, analysis, and preparation of a summary report of major findings from the international science survey. The report from this project will result in important cross- country analyses of student achievement and curriculum coverage of science in the classroom.

This supplement will also permit the continuing analysis of U.S. student performance in science vis-a-vis the other countries. Specifically, a report will be prepared on: "Science Education in the United States and other countries: A Report to the Public."

STUDIES AND ANALYSES

Richard M. Wolf	OSPA 8652162
Teachers College	FY87 $40,000
New York, NY	Studies

"International Educational Achievement Association - General Assembly Meeting"

This project is supported by an interagency agreement with the Department of Education. It is awarded to Columbia Teachers College to host the 1987 General Assembly meeting of the International Association for the Evaluation of Educational Achievement (IEA). IEA is a non-profit international educational research association that conducts multi-national studies of precollegiate achievement of students in various school subjects. The United States is one of the founding members of IEA and has participated in virtually all of its studies. The results of IEA studies have furnished important information to educators and policy-makers in the United States, including international comparative data on mathematics and science achievement and teaching in the schools.

STUDIES AND ANALYSES

Richard M. Wolf	OSPA 8850487
Teachers College	FY88 $160,829
New York, NY	FY89 $312,235
	Studies

"Analysis and Data Preparation for the Second International Science Study"

This proposal is an extension of analysis of data from the Second International Science Study (SISS). SISS is an international survey of 24 countries conducted in 1983. The survey was repeated in the U.S. in 1986 because of poor participation rates of schools in the 1983 effort. Later analysis of the

SISS data resulted in the report "Science Achievement in Seventeen Countries", which has received a great deal of attention, mainly because of the relatively poor performance of U.S. students in science achievement.

Under this grant, in-depth analyses will be conducted on the factors that explain science achievement in the various countries. Some of these factors involve the science curriculum, its structure (integrated vs. layer-cake approach), and the opportunity to learn and an estimate of how much can be learned by certain age levels, even by the bottom 25 percent of students. Some of the effect that this and the amount of homework has on achievement and in-service training, involvement in science projects, the planning of lessons and the relative salaries of teachers will be examined. An the effect of yet other variables to do with school organization such as school and class size will be examined.

The report from this project should result in important international analyses of student achievement in science that will be useful to science educators and others in advocating changes designed to improve science instruction and teaching.

This project is being supported jointly by the National Science Foundation and the U.S. Department of Education.

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INSTRUCTIONAL MATERIALS DEVELOPMENT

Yngvar W. Isachsen MDR 8651656
William B. Rogers FY87 $120,100
The University of the State of NY Geology
Albany, NY

"Geology of New York State: A Synopsis for Precollege Science Students and Their Teachers: A Model for Other States to Emulate"

Geology of New York State will be a well illustrated, two-part publication designed to lead the precollege student into the world of natural science through geology, an approach that capitalizes on the fascinating natural laboratory that is just outside every classroom. A sixty-page booklet will give an up-to-date synopsis of the State's remarkably varied geology. A large, full-color sheet, with a number of maps on both sides, will present the essence of the subject through graphics. It will feature a geologic highway map of New York and a space-satellite photomap printed at the same scale. This pair will display dramatically the control of geology on physiography, thus reinforcing the connection between the students' science courses and the familiar world.

This publication will enhance precollege science learning by (1) piquing the students' curiosity about natural phenomena and providing a practical guide to accessible examples; (2) helping elementary and secondary earth science teachers prepare a more interesting course by providing them with insights into the local geology; and (3) creating a cadre of teachers to hold workshops for their colleagues throughout the State.

The project has potential for significant impact in a number of areas. These include: raising the awareness of future voters about their geological environs and the impact of technologies upon these. The use of the publication by interested adults will improve the public's awareness and appreciation of science - a condition necessary for science to flourish in the schools. Further, the project will provide a high quality model for other states to produce similar materials.

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Stanley I. Sandler SEE 8715115
Bruce A. Finlayson FY87 $31,400
United Engineering Trustees Inc Chemical Eng
New York, NY

Support of Conference "Chemical Engineering Education in a Changing Environment"

The Engineering Foundation Conference "Chemical Engineering Education in a Changing Environment" is a unique attempt at rapidly introducing high technology applications, such as the processing of electronic and photic materials, biochemical processing, the handling of hazardous materials and wastes, biocontainment, and electrochemical processing into the standard chemical engineering curriculum. This will be done by having invited speakers briefly introduce their technology areas, and then discuss one or two detailed examples of the use of chemical engineering fundamentals to solve problems in these new technology areas. These examples and their solutions will be in a form that chemical engineering faculty unfamiliar with these technology areas could nonetheless use directly in standard courses such as thermodynamics, fluid mechanics, mass transfer, kinetic and reactor design.

This project provides financial support to allow chemical engineering faculty to attend the Conference "Chemical Engineering Education in a Changing Environment", and to prepare and distribute the Proceedings of this Conference.

This project is funded jointly with the Directorate for Engineering.

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RESEARCH IN TEACHING AND LEARNING

Raffaella Borasi MDR 8651582
University of Rochester FY87 $65,594
Rochester, NY FY88 $80,282
Mathematics

"Using Errors as Springboards for Inquiry in Mathematics Instruction"

This project will explore strategies for using students' mathematical errors that will examine the potential of errors to motivate and direct activities involving problem generating, problem solving, and critical thinking. This is in contrast to the current practice that focuses solely on obtaining correct answers and eliminating errors as quickly as possible. A combination of conceptual and empirical investigations will be employed. This approach will include the in-depth study of several errors to unravel their potential to motivate creative activities; the development of instructional material which makes use of such potential; a conceptual analysis of the possibility of using errors as motivation and means for inquiry with different audiences; the analysis of students' reactions to implementations of the strategy in instructional contexts at the secondary level, both in natural classroom settings and in "teaching experiments" with small groups.

Findings from this research should assist in understanding the role of errors in education and lead to further occasions in mathematics instruction for crucial activities such as problem solving and critical thinking. Though this project will focus on the use of errors in mathematics instruction at the secondary level, it will create the basis for the application of a reconstructed view of the educational role of errors with other audiences and in other subject areas.

TEACHER PREPARATION PROGRAM

Herbert P. Ginsburg	TPE 8550880
University of Rochester	FY85 $334,758
Rochester, NY	FY86 $ 20,305
	FY88 $ 37,227
	Mathematics

"Children's Mathematical Thinking: Video Workshops For Educators"

This award is a supplement to the NSF Grant MDR-8470191, Children's Mathematical Thinking: Video Workshops for Educators. The purpose of the original project was to develop and evaluate a series of videotape workshops for elementary mathematics educators based on research and theory concerning the development of children's mathematical thinking. As a result of that award the following material has been developed:

*A series of 12 edited videotapes of "clinical interviews" that illustrate aspects of children's mathematical thinking.

*A set of written workshop manuals to accompany the taped material for use by workshop leaders.

*A collection of reading materials to complement and supplement the workshop content.

This supplement will provide funds for testing the material so that it can be further refined before large scale dissemination is begun.

COLLEGE SCIENCE INSTRUMENTATION

William F. Pfeiffer	USE 8851770
Utica College of Syracuse Univ	FY88 $25,639
Utica, NY	Chemistry

"Fourier Transform Infrared (FTIR) Spectroscopy in Undergraduate Laboratories"

The project is a major step in the continuing enhancement of the inorganic and instrumental capabilities of the Chemistry program. A FTIR spectrometer and associated computer software has been purchased for use by the students in the laboratories beyond the Freshman courses. The students are thereby gaining direct experience with a modern spectrometer and benefit from its speed and accuracy in their laboratory assignments. The students are also gaining direct experience with the power and convenience of the computational routines that are possible with digitized data.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Janet K. Andrews	USE 8750798
Vassar College	FY87 $14,576
Poughkeepsie, NY	Psychology

"Enhancement of Laboratory Facilities in Human Perception and Cognition"

This project will assist the Vassar College psychology department in modernizing and expanding its laboratory facilities in human perception and cognition. There is a strong need for this enhancement due to curricular expansion and student interest in this growing subarea of psychology, particularly given recent changes in major requirements. Students in psychology, biopsychology, and cognitive science will benefit from the use of computerized stimulus presentation and data collection, graphics, voice synthesis, eye movement tracking, and data loggers through intermediate and laboratory courses in perception and cognition and student independent work in these areas. Available facilities and expertise will allow for optimal use of this equipment to illustrate central methodological techniques in the current study of human perception and cognition through exercises and demonstrations as well as more independent student research. The scientific education of a significant number of undergraduates, particularly women, will be enhanced in the context of a high quality liberal arts institution which has the resources and commitment to support this initiative.

COLLEGE SCIENCE INSTRUMENTATION

Mark A. Schlessman	USE 8852608
Vassar College	FY88 $48,900
Poughkeepsie, NY	Biology

"Equipment for Teaching and Student Research in Plant Ecology and Evolutionary Biology"

The equipment purchased through this project is to improve laboratory instruction and enhance opportunities for undergraduate student research in Plant Ecology and Evolutionary Biology. Several functionally related items being installed include plant growth chambers, balances, a portable photosynthesis system, a portable leaf area meter, and a datalogger. This new equipment responds to increased student interest in ecology and evolutionary biology by assisting the faculty to (1) introduce new courses in Aquatic Biology and Population Biology, (2) add a new laboratory component to the existing Evolutionary Biology course, and (3) improve laboratory instruction in five other existing courses.

In the instructional laboratories, the new equipment is being used in a variety of exercises that include investigations of the effects of environmental parameters on plant growth, development, and metabolism; experimental studies of plant competition under controlled environmental conditions; and studies of the inheritance of traits affected by many genes.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Lawrence W. Ward	USE 8750485
Webb Institute of Naval Architecture	FY87 $15,726
Glen Cove, NY	Civil Eng

"Improvement of a Model Towing Tank for an Undergraduate Naval Architecture Laboratory"

This project is to build a unique model towing tank facility by the addition of new transducers, data acquisition, recording and analysis equipment to an existing tank. The resulting equipment will allow students to run experiments similar to those commonly done in industry. The new junior year engineering laboratory course is part of a major revision of the overall curriculum in the field of navel architecture and marine engineering.

COLLEGE SCIENCE INSTRUMENTATION

Christopher T. Bailey	USE 8851384
Wells College	FY88 $14,640
Aurora, NY	Chemistry

"Inorganic Chemistry for Undergraduates: Necessary Instruments"

This small liberal arts college for women with a strong tradition of training women in the sciences is reintroducing a course in Inorganic Chemistry and requiring it for the Chemistry major. The course, as it is being offered, is open to students of sophomore standing or higher. The instruments necessary for an undergraduate course in Inorganic Chemistry, a fast-scan UV/Vis Spectrophotometer, an Atomic Absorption Spectrometer, and a Magnetic Susceptibility Balance, were chosen due to the ease of obtaining and interpreting data, and the ability of these instruments to examine both gross physical properties and molecular and atomic properties. The experiments being performed with these instruments reinforce or substantiate the concepts introduced in the classroom, rather than simply giving the student "experience" doing a particular manipulation or using the particular instrument. For most experiments the students are working independently in obtaining certain data, but then, as a class, share and evaluate the data in discovering and developing patterns. By allowing sophomores to take this course they are hoping to give more students the opportunity to pursue advanced studies in Inorganic Chemistry.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Jo Sanders	TPE 8751555
Women's Action Alliance	FY88 $248,288
New York, NY	Computer Science

"New York State Computer Equity Project"

This project will promote computer equity for girls in middle school. The first phase of the project will develop training materials that will enable school district computer coordinators to conduct faculty workshops on computer equity and to guide the implementation of computer equity strategies in schools in their districts. These strategies are based on the premise that the best way to interest girls in computers is to introduce them first to elementary applications, such as word-processing, and then to lead them to higher-level uses. The training materials will consist of a workshop Leader's Guide, a two-hour workshop that discusses the causes of the "computer gender gap" and summarizes strategies for closing it.

In the second phase of the project, these materials will be pilot-tested in four school districts in New York State. A computer coordinator and an administrator from each district will first attend a two-day training session that will prepare them to conduct the two workshops for teachers in their districts. Each test school will then develop and implement its own computer equity program.

The project will be evaluated by its impact on girls' interest and achievement in mathematics, science, and computer science. Data will be collected about voluntary computer use by boys and girls and about enrollments in elective courses in mathematics, science, and computer science.

The Women's Action Alliance and the participating school districts are contributing an amount in cost-sharing that is equal to 26% of the NSF award.

NORTH CAROLINA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Helen M. Stone
Science
Ben L Smith High School
Greensboro, NC

Jean F. Taylor
Mathematics
John T Hoggard High School
Wilmington, NC

1988

Wallis Green
Mathematics
C E Jordan High School
Durham, NC

Philip R. Dail
Science
Garner Senior High School
Garner, NC

COLLEGE SCIENCE INSTRUMENTATION

William C. Bauldry USE 8853085
Appalachian State University FY88 $45,680
Boone, NC Mathematics

"Mathematical Sciences Microcomputer Teaching Laboratory"

The Mathematical Sciences Department will construct a mathematical science microcomputer teaching laboratory for their calculus and discrete mathematics sequences.

An electronic classroom of interconnected student workstations, printers and instructor demonstration unit will provide instant computer access during lectures. The laboratory will be used by students to conduct experiments and complete out-of-class assignments.

Members of the faculty have developed a new curricula, software and are writing a Calculus Laboratory Manual.

The grantee is providing a slightly greater sum obtained from non- Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Milan C. Buncick USE 8852985
Appalachian State University FY88 $22,398
Boone, NC Physics

"Thin Film Deposition and Etching Facility for Undergraduate Physics Students"

The grantee institution will purchase a high-vacuum pumping station, an RF/DC sputtering system, and an electron beam evaporation and etching system. This equipment will be used to improve instruction in upper-division Physics laboratory courses. Experiments in vacuum technology and thin film properties will be introduced, and microstructures fabricated with the equipment will be used in new experiments in opto-electronics. Advanced undergraduate students also will use the equipment for individual projects.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Daniel B. Caton USE 8852993
Appalachian State University FY88 $100,000
Boone, NC Astronomy

"A Modern Technology Telescope for Undergraduate Student Projects and Research "

A modern telescope that incorporates many advanced technology features will be acquired for use by undergraduate Physics/Astronomy majors. These students will use the telescope to learn research techniques in observational astronomy, in addition to acquiring valuable original scientific data. Students will make their own observations, analyze the data, and prepare the results for publication. In addition, they will learn first-hand the operation of modern astronomical instrumentation.

The telescope will be installed at Appalachian State University's Dark Sky Observatory, located in the mountains of western North Carolina. The telescope will be equipped with a variety of auxiliary instruments, which exist presently or which will be acquired with university funds. These include a photometer to measure the brightness of variable stars and a CCD video camera to acquire images of stars, galaxies, quasars, and comets. A spectrograph will be used to obtain stellar spectra of sufficient quality to determine a star's spectral type (temperature and size).

Observations and instrument control will be done remotely from a warm-room, in much the same style as modern research observatories. Students will also explore the possibility of remote control of the observatory from campus, via telecommunications. Thus, the newer and larger telescope will not only replace the function of the obsolete telescopes currently at the site, but it will also take a great step forward into the next generation of telescope instrumentation.

The grantee institution is matching he NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Mary U. Connell USE 8853233
Appalachian State University FY88 $20,724
Boone, NC Biology

"Undergraduate Investigative Laboratories for Understanding Physiological Systems"

The areas of Cellular/Molecular Biology and Physiology are becoming increasingly difficult to teach because of the rapid advance of knowledge and the technical methodologies they employ. Compounding the already difficult task of instruction is the students' lack of understanding of how to investigate physiological systems. These facts lead to the two main objectives addressed in the present effort to improve instruction in the affected laboratories:

(1) To give students experience with suitable equipment in order to develop their understanding the behavior of physiological systems (using an instrument not only develops a student's lab skills; it encourages the development of a sophisticated understanding of the concept or system which cannot happen in any other way).

(2) To provide the student with a laboratory experience that is investigative in nature.

In order to accomplish these objectives, the Cellular/Molecular and Physiology laboratories are being restructured by developing three different types of labs: Concepts-Skills, Inquiry, and Investigative. These facilitate the exploration of topics in the lab which previously could be pursued only in lecture.

The above changes are intended to:

1) increase the student understanding of the conceptual framework upon which a physiological/cellular/molecular investigation is based;

2) increase the students' ability to work with the type and quality of data gathered in cellular/molecular and physiological investigations;

3) develop in the students a sense of inquiry, understanding and appreciation of the functional aspects of Cellular/Molecular Biology and Physiology; and

4) increase the students' own investigative abilities.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

William A. Imperatore USE 8750863
Appalachian State University FY87 $12,617
Boone, NC Geography

"Enhancement of Computer Cartography Instruction and Laboratory"

The Department of Geography and Planning at Appalachian State University has begun the implementation of a plan for improved instruction in the area of computer assisted cartography. The equipment requested for this project is needed for the next phase in the evolution of its instructional capabilities in computer mapping technology. Students will work on projects in which they will generate digit files of geographic entities of varying size and scale; produce high quality choropleth and overlay maps of large data bases using commercially available map bases; generate maps at different scales; combine maps of different scales on a single page; change perspectives of computer generated maps; and use geographic information system analysis techniques. Students will also receive experience with a large format digitizing tablet and multi-pen/multi-color plotter which is standard in public and private agencies which employ geographers, planners, draftsmen, designers and other scientists who work with spatial information. This project is responsive both to trends in the discipline and advances in the available technology.

COLLEGE SCIENCE INSTRUMENTATION

Karl C. Mamola USE 8750796
Appalachian State University FY87 $18,149
Boone, NC Physics

"Modern Optics Equipment for Undergraduate Laboratories"

Appalachian State University will upgrade optics laboratories for undergraduate instruction. A modern optics laboratory will be instrumented for a senior-level course, Optics and Optoelectronics. The laboratory component of this course will include traditional experiments in geometrical and physical optics but will emphasize contemporary topics in optical science such as lasers, fiber optic communication, and holographic techniques. An important part of the laboratory work will be the use, in selected experiments, of microcomputers for data acquisition and instrument control as well as for data analysis. The computer hardware and some of the necessary optics equipment has already been acquired. All of the experiments have been designed and developed and, to the extent possible, tested with the limited equipment on hand.

A number of classical optics experiments currently performed in existing upper-level physics laboratory courses will also be upgraded by supplementing or replacing some older one-of-a-kind apparatus with present generation equipment. Introductory courses for science and pre- engineering majors and others will also be improved by the project.

TEACHER ENHANCEMENT PROGRAM

H. William Paul	TPE 8651498
Harriet Cornwell	FY86 $132,242
Appalachian State University	FY88 $ 11,353
Boone, NC	Mathematics

"Northwest Region Mathematics Teaching Enhancement Program"

This four-year project will strengthen the mathematics backgrounds and teaching skills of sixty mathematics teachers from grades 9-12 in northwest North Carolina. The project is now completing its second year. Each summer, two intensive courses are offered, each meeting for 5 hours per day for ten days. Some of these courses are taught by one faculty member and some by a team of two faculty members.

COLLEGE SCIENCE INSTRUMENTATION

Edward G. Pekarek	USE 8852020
Appalachian State University	FY88 $16,175
Boone, NC	Computer Science

"Computer Operating Systems Instructional Improvement Project"

This project permits undergraduate students in Computer Science to experiment with practical operating systems programming in a laboratory environment. Working in teams, students both modify and enhance an existing operating system. The laboratory that supports this project includes PC-AT clones (with floppy and hard drives) running the MINIX operating system. The laboratory experience permits students to gain practical knowledge about operating systems, knowledge that is often overlooked in a traditional operating systems course.

This award is being matched by an equal sum from the grantee.

INSTRUCTIONAL MATERIALS DEVELOPMENT

L. M. Perry	MDR 8751110
Gary Kader	FY87 $169,994
Appalachian State University	Mathematics
Boone, NC	

"Simulation in Mathematics - Probability and Computing (S.I.M.-P.A.C.)"

This project is a response to mounting evidence that the secondary school curriculum does not provide adequate experiences in mathematical modeling, problem solving, the probability concepts. The proposed instructional design emphasizes an eight step simulation model building process, and the process of exploring simulation models as a strategy for developing problem solving skills and for understanding probability concepts.

The approach to development of the materials is comprehensive: consideration is given to the student, teacher, and teacher training, with special attention given to the teacher's role in influencing instructional styles and curriculum change.

The materials for implementing the instructional design and strategy include a student manual, teacher manual, and teacher training manual. These printed materials will be accompanied by computer software and instructional fields for use by teacher and student.

COLLEGE SCIENCE INSTRUMENTATION

Stephen D. Williams	USE 8750809
Appalachian State University	FY87 $20,050
Boone, NC	Chemistry

"Gas Chromatography/Mass Spectrometry in an Undergraduate Chemistry Curriculum"

The Chemistry Department at Appalachian State University has recently acquired an ion trap mass spectrometer and a microcomputer system which when interfaced with a gas chromatograph affords undergraduate students opportunities to expand their experience with modern instrumentation. Student use of this system is an integral part of a course in natural products chemistry, and one devoted to the use of computerized instrumentation. In addition, the instrument is used in introductory courses as a lecture demonstration tool and as a qualitative and quantitative tool in the organic chemistry laboratory.

COLLEGE SCIENCE INSTRUMENTATION

Michael J. McLeod USE 8851571
Belmont Abbey College FY88 $11,650
Belmont, NC Biology

"Equipment for an Undergraduate Laboratory Program in Cellular Biology"

The Biology Department is updating and modernizing its Cell Biology course, particularly the laboratory component, as part of a general shifting of emphasis in the departmental curriculum. This is being accomplished in part by obtaining instrumentation needed to perform experiments in cell function and in DNA structure and function. These areas are important to a modern course in Cellular Biology.

Previously the laboratory portion of the Cell Biology course was organized in a classical manner, with a minimum of experimentation and analysis. With the acquisition of the new equipment, the course uses the accumulation and interpretation of experimental results to illustrate concepts and material. These instruments also are useful in the Genetics and Biochemistry courses. The equipment includes a refrigerated centrifuge, microcentrifuge, analytical balance, pH meter, and gel electrophoresis apparatus. With the new equipment, undergraduates perform basic experiments on DNA. These include the mapping of restriction fragments, and analyses of enzyme actions and kinetics.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Steven J. Coggin USE 8750386
Michael J. Baranski FY87 $30,256
Catawba College Biology
Salisbury, NC

"Modern Cellular and Molecular Biology in the Undergraduate Curriculum"

Modern Cellular Biology and Genetics courses for majors are being developed with the purchase of major instruments including a tabletop ultracentrifuge, a high speed refrigerated centrifuge, three general-use spectrophotometers and five phase contrast microscopes.

The equipment is being used in the preparation of cell extracts and enzyme assays, plasmid purification, recombinant DNA techniques, organelle isolation, the observation and experimental manipulation of cell-cell interactions using animal gametes, and for various undergraduate research topics in Cellular and Molecular Biology.

COLLEGE SCIENCE INSTRUMENTATION

Felix A. Carroll USE 8750021
Davidson College FY87 $9,921
Davidson, NC Chemistry

"Improving Undergraduate Instruction in Chemistry Through the Use of a Photodiode Array Ultraviolet-Visible Spectrophotometer"

The recent acquisition of a photodiode array ultraviolet-visible spectrophotometer is being used in the teaching of chemical principles and laboratory techniques to chemistry majors, other science majors and/or premedical students, and non-science majors at Davidson College. The speed of the instrument allows complete spectra to be acquired within seconds, displayed on a monitor, stored on disk, mathematically manipulated, and printed. The instrument is being used for kinetic experiments that require absorption values at more than one wavelength to be measured simultaneously. It also serves as a detector for high performance liquid chromatography, thus introducing students to principles of chromatography-spectrophotometry. Chemistry majors study the principles of operation of this computer-controlled instrument, with emphasis on concepts of digital electronics, instrument control, data file structures, and data transfer operations. The instrument is also used in student research projects involving organic photochemical reactions, the characterization of transition metal complexes, and investigation of the function of proteins.

COURSE AND CURRICULUM

Lawrence C. Moore, Jr. USE 8814083
David A. Smith FY88 $20,000
Duke University Mathematics
Durham, NC

"Development of Calculus"

In a cooperative venture, Duke University and the North Carolina School of Science and Mathematics - a high school - will develop a detailed syllabus for a new Calculus curriculum.

Both schools will experiment with the use of computer algebra systems and prepare sample modules. Duke University will run a small prototype calculus laboratory for the development and testing of interactive experiments and writing as a learning tool in mathematics.

Central themes will include appropriate use of mathematical and physical tools, identification of a concept and its inverse, use of transformations, and relationships between calculus and real world problems.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

RESEARCH IN TEACHING AND LEARNING

Robert N. Sawyer	MDR 8751410
Gordon E. Stanley	FY87 $69,937
Duke University	Mathematics
Durham, NC	

"A Conference on Academic Talent: Developing Talent in Mathematics, Science and Technology"

In recent years we have seen renewed interest in increasing the pool of individuals who are capable of solving problems in mathematics, science and technology. This search for talented persons has brought with it increased attention to the deficits of current identification models and of largely unproductive teaching/nurturing practices.

A three day conference involving approximately twenty of the nation's best scholars and most productive individuals in the areas of human intelligence, developmental theory, academic precocity and talent in mathematics and science, and institutional and governmental leadership will be convened to focus on factors involved in identifying and facilitating the expression of high academic ability. The conference will explicate critical issues in the area of gifted and talented education and propose priorities for research and policy. Conference papers will be made available to the mathematics and science education communities through written conference proceedings.

The proposed conference will provide much needed attention to the current policies and practices affecting the development of mathematical and science talent in this country. An increased emphasis on identifying and nurturing talent from previously underserved and underrepresented groups will also be evident.

APPLICATIONS OF ADVANCED TECHNOLOGIES

David Lunney	TPE 8722944
Robert C. Morrison	FY88 $80,000
East Carolina University	Chemistry
Greenville, NC	

"Functional Group Analysis of Infrared Spectra Using Auditory Pattern Recognition"

This project is in the general area of analytical and surface chemistry, broadly defined. The thrust of this experimental activity is an investigation of approaches to extracting molecular functional group information from infrared spectra and presenting this information as auditory patterns, primarily for the benefit of visually impaired scientists. These investigators have previously developed several schemes for presenting tabular and graphical data as electronic music and now seek to extend that work to develop methods that can be used to assist in the detailed analysis of infrared spectra. A central feature of this project will be the use of chemometric techniques to select features from infrared spectra which can distinguish organic functional groups and present these features as auditory patterns that will enable a listener to discern whether or not certain functional groups are likely to be present in a particular molecule. An essential part of this research will be the determination of the features of the spectra to be used for generating the sound patterns.

This research has broad applications to chemistry and other experimental fields in science and engineering. Additionally, this project is important to Foundation activities in both the Science and Engineering Education and Computer and Information Science and Engineering Directorates. The techniques to be developed in this research could be useful to sighted as well as to visually impaired scientists.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

COLLEGE SCIENCE INSTRUMENTATION

R. P. Sinha	USE 8851190
Elizabeth City State Univ	FY88 $5,551
Elizabeth City, NC	Geology

"Dual Polarizing Microscopy for Undergraduate Teaching Program "

The Department of Geosciences will purchase a dual ocular polarizing microscope with television monitor and ancillary equipment. This instrument will be used primarily to improve instruction in three upper-division Geology courses: Mineralogy, Optical Mineralogy, and Petrology. It will allow instructors to demonstrate the properties of both coarse and fine grained mineral specimens to the classes. It also will allow the instructor and student to observe specimens simultaneously to ensure that the student correctly interprets the various features of the specimens.

The grantee institution is one of three historically black institutions offering an undergraduate degree in Geology. The NSF award will be matched by an equivalent amount from the grantee.

PRIVATE SECTOR PARTNERSHIPS

Samuel S. Smith	TPE 8851026
Iona Tyson	FY88 $ 54,600
Richard Marshall	FY89 $109,200
Anne G. Garrett	Environmental
Haywood County Schools	
Waynesville, NC	

"Student Perspectives on Waste Management and Environmental Concerns"

Local industry, government, and college personnel will work with the Haywood County Schools to develop curriculum materials and activities which will integrate local waste control and environmental issues into science and mathematics classes for grades 4-12. Teachers will be trained to use the materials through inservice programs, visits to industrial and municipal sites, and interaction with industry and governmental scientists and engineers. When the materials are put into use in the classes, students will be involved in site visits, external activities, and research projects in addition to in-class activities. The dual objectives are to teach the students about these real-world problems and to show them how mathematics and science knowledge are important in dealing with community and societal concerns.

Cost sharing by the partners will total 28% of the NSF funding.

NETWORKS PROGRAM

Iris R. Weiss	TPE 8850608
Horizon Research Inc	FY88 $132,892
Chapel Hill, NC	FY89 $135,937
	FY90 $103,414
	Studies

"Dissemination of Information about Science and Mathematics Education"

This project will enhance the use of data in the making of informed policy and programmatic decisions at the national, state, and local levels by disseminating information on the status of science and mathematics education. Initially the project will be based on the recently completed report of the 1985-86 National Survey of Science and Mathematics Education. Later, other studies such as the National Assessment of Educational Progress(NAEP), the international science and mathematics assessments, and state data gathering programs will be included. The participants in the project will include national professional organizations, state science and mathematics supervisors, and others interested in the status of science and mathematics education. Each participant will be provided with briefing books which summarize the data through pie charts, bar graphs, and tabular results presented in the form of transparency masters and camera ready copy. Basic training in survey design will also be provided so that policy makers and program personnel will be better able to judge the adequacy of survey efforts and decide when policy changes are indicated.

COLLEGE SCIENCE INSTRUMENTATION

Geoffrey L. Wilson	USE 8750823
Johnson C Smith University	FY87 $17,767
Charlotte, NC	Physics

"Enhancement of the Laboratory Experience in Introductory Physics Courses through the Use of Computers"

Physics is both an experimental and a theoretical science, involving an interplay between observed phenomena and their description in mathematical terms. Thus a substantial laboratory experience is an essential component in a proper study of and understanding of the discipline. Johnson C. Smith University will improve the quality of its undergraduate laboratory instruction in Physics by replacing outmoded equipment with personal computers. These, with appropriate interfacing devices, will be used as measuring instruments to collect data from the students' experiments, and also as tools for analyzing the data and presenting the results. The new laboratory program is expected to increase student interest, and thereby student confidence and competence, and to attract uncommitted students towards a career in the physical sciences and engineering.

COLLEGE SCIENCE INSTRUMENTATION

Theodore B. Jaeger	USE 8750245
Methodist College	FY87 $9,522
Fayetteville, NC	Psychology

"Developing Scientists in Psychology"

A year-long Developing Scientist Program for seniors in psychology is enriching the scientific training of talented psychology majors. To implement the program, the college is establishing a psychological laboratory equipped with five Apple IIGS computers and an interfaceable biofeedback system. Research projects are being carried out in the traditional experimental areas. The students are receiving advanced seminar and one-on-one instruction in hypothesis formulation, design, and execution of experiments, and in data analysis and interpretation. They are each performing one project per semester for two semesters and will prepare experimental reports in journal form describing the projects. The program is enhancing the skill of the students in applying the scientific method to contemporary research problems in psychology, leading ultimately to them making significant contributions to the fields of psychology.

COLLEGE SCIENCE INSTRUMENTATION

Sanjiv Sarin	USE 8750634
North Carolina Agricultural and Technical University	FY87 $38,660
Greensboro, NC	Industrial Eng

"Enhanced Undergraduate Instruction in Graphics Science"

This project is to create a computer graphics laboratory in the Department of Industrial Engineering. Twelve Tektronix graphics terminals and digitizing tablets will be connected to a host Vax computer. Three area of graphics will be stressed. In addition to the conventional uses for computer graphics, communication and documentation, the idea of "ideation" will be explored. This idea is to give the engineering student a graphical tool to enable the student to visualize the design of an item. This should help the student to be more creative without spending a lot of time at the drafting board making paper images.

TEACHER ENHANCEMENT PROGRAM

Jasper L. Harris	TPE 8850348
North Carolina Central University	FY88 $58,263
Durham, NC	Geology

"Contemporary Issues in Earth Science for Middle Schools"

This science teacher development project at North Carolina Central University will provide middle school teachers with updated content concepts, materials, and curriculum development. Twenty-five middle school teachers (grades 5-8, earth science teachers) will be enrolled in a semester workshop held during the spring semester of the academic year 1988-89. The ten-week program will include fourteen three-hour evening sessions and four day-long Saturday field trips. The workshop will review new concepts, effective ways of incorporating contemporary issues, the use of computer assisted instruction, and the importance of field experiences in the curriculum.

Major areas of study will focus on four basic units: Introduction to Earth Systems, Atmospheric Systems, Geological Systems, and Hydrological Systems. A field trip is scheduled for each major unit. The formal workshops will emphasize laboratory activities which illustrate the four basic units and can be used, with minimal modifications, in the classroom. During the follow-up phase, participants will work under the direction of the workshop staff to incorporate the workshop materials into existing courses. Upon successful completion of the project, teachers will be awarded six continuing education units or three hours of graduate credit.

This project is important to the Teacher Enhancement Program since it addresses an area which has been ignored in our middle school curriculum. It also allows teachers the opportunity to assume ownership of the curricular materials used in their classrooms.

PRIVATE SECTOR PARTNERSHIPS

Byard Houck, Jr.	TPE 8851051
Leo Edwards, Jr.	FY88 $131,630
Laura Artis	FY89 $139,214
Katherine Hodgin	FY90 $147,428
Vernon R. Thompson	Other NEC
North Carolina Council for Minorities in Science, Mathematics, and Industry	
Raleigh, NC	

"Educational Reach for Technological Literacy (ERTL)"

The North Carolina Council on Minorities in Science, Mathematics and Industry, jointly organized by the Governor's office, North Carolina State University, and the state Department of Community Colleges, is working with 17 school systems and 55 industries to increase technological literacy of junior/senior high school students and to increase the number of minorities entering technical, scientific, and engineering trades and professions. Through this program, the Council will enhance local understandings of the importance and relevance of modern technology by developing greater technological literacy among teachers and students and extending that literacy to the general public. Activities with teachers will include placing teachers in summer internships in industry, development of technology education materials through joint efforts of these teachers and industrial scientists and engineers, and providing in-service programs for sharing these materials with other teachers. Students will use these materials in science and mathematics courses and in new or expanded courses in Principles of Technology courses. Industry on Parade exhibits, rotated among different sites in the state, will be a part of the program by bringing to the general public, as well as to students and teachers, an improved appreciation of the nature and importance of modern manufacturing and product technology.

Cost sharing by the partners will total 245% of the NSF funding.

INFORMAL SCIENCE EDUCATION

Thomas H. Krakauer	MDR 8651995
North Carolina Museum of Life	FY86 $ 42,250
and Science	FY87 $ 62,939
Durham, NC	FY88 $182,700
	Biology

"The Science Behind Medicine: The Shape of Things to Come"

This project at the North Carolina Museum of Life and Science will create a 2000 square foot permanent exhibition, "The Science Behind Medicine", using recent advances in medical science and technology to illustrate basic science concepts. It will engage visitors through their strong interest in health and medicine, present valuable information about medical subjects, and use their interest to present underlying scientific concepts they would otherwise avoid.

The exhibition will be organized around four topics: organ structure and function and organ replacement and transplantation; advances in medical imaging, including infrared, ultrasound and x-ray technologies; pharmaceutical pharmacology, biological receptors and molecular design; and sickle cell anemia and its molecular biology. Over five years, more than one million people will use the exhibit, including both highly educated residents of the Research Triangle area, and a Durham population that is disadvantaged and 50% black.

Extensive subject area consultation and formative evaluation will be used in exhibition design. A close consulting relationship is planned with two museums with similar exhibit interests, and exhibit research and plans will be offered to other interested museums to encourage wider use of the project's results.

A strong regional health sciences focus will benefit the project through academic, business, community and industry membership on a project planning committee, and from 50% local matching funding. Two corporate planning grants have been awarded to the project, and a major facilities expansion funded in part by a recent bond issue.

TEACHER ENHANCEMENT PROGRAM

Steve Davis	TPE 8652378
North Carolina School of Science	FY87 $143,652
and Mathematics	Mathematics
Durham, NC	

"National Workshops for Introduction to College Mathematics"

The North Carolina School of Science and Mathematics will conduct National Workshops for Introduction to College Mathematics for 44 high school teachers from 11 districts nationwide. Eight of these districts are members of the Urban Mathematics Collaboratives program sponsored by the Ford Foundation, which will assist in support of the participants in their schools. Building on materials for fourth-year high school mathematics developed by the staff under Carnegie Corporation of New York funding, the participants in this program will have an intensive 12-day summer training in mathematics and leadership skills and then, based on their academic year experience and schoolroom use of the materials, help to develop new materials for in-service workshops which they will conduct in their districts for over 200 mathematics teachers of grades 7-12 in the second summer.

The primary goal of this project is that middle and high school teachers experience a professional opportunity which will result in growth and a greater involvement in mathematics education along with a change in the perception of themselves with regard to mathematics education. The new Carnegie-funded syllabus used for the workshops exposes participants to six modes of mathematical thought: geometry, analysis of data, probability and statistics, mathematical models of the real world, computers, and finance. With a focus on application, reflecting advances in technology, this new course, which includes mathematics of contemporary importance, will provide better preparation for students who will encounter the changing role of mathematics in a wide range of college majors and careers.

The PI is Head of Mathematics and Computer Science at NCSSM and has received grants in previous years from NSF, NIE, Apple Foundation, Carnegie and IBM to develop tool packages of use in mathematics and science, educational applications of clustering and a syllabus for Fourth Year High School Mathematics. NCSSM is eminently qualified in terms of staff, faculty, facilities, and institutional commitment, to act as a national leader in the development of new ideas in instruction. The NCSSM syllabus responds to the challenges posed by NCTM'S Agenda For Action and other reports. The PI has conducted numerous successful workshops in the past five years and has developed materials which are suitable for them in scope and philosophy. Each teacher will receive training in four areas: 1) Units in unfamiliar mathematics; 2) Motivating applications; 3) Effective use of a single computer in front of a classroom to deliver instruction; 4) The philosophy behind the syllabus. The training materials will provide better problem solving skills and increase the breadth of mathematical experience.

TEACHER ENHANCEMENT PROGRAM

Karen L. Johnston	TPE 8751705
North Carolina State Univ	FY88 $132,533
Raleigh, NC	Physics

"Teaching Physics Teachers with Technology"

Teaching Physics with Technology is a modified Chautauqua type program which will provide in-service preparation for 75 high school physics teachers in North Carolina. The teachers will receive training in the use of educational technology in physics teaching. This model is unique in that two two-day workshops are separated by a six- to seven-month period. In the interim, a one-week summer workshop is held. The first two-day workshop provides an overview of the use of educational technology in physics teaching. The summer workshop is used to present several mini-lessons in several areas of modern and classical physics, and to provide time for the teachers to develop teaching modules employing educational technology. Teachers will work in teams with each team producing one module. The final two-day workshop is used to revise and edit the modules based on classroom experience with them.

TEACHER ENHANCEMENT PROGRAM

John R. Kolb	TPE 8751330
Sarah B. Berenson	FY87 $183,069
North Carolina State University	Mathematics
Raleigh, NC	

"Improving Leadership Skill Among High School Mathematics Teachers with Collaborative Research"

This project intends to investigate uses of computers in mathematics classrooms and to develop research capabilities of teachers for the purpose of improving their leadership skills. There are four goals to the proposed project:

1. To introduce into algebra and geometry classrooms computer software by introducing teachers to research methods and developing instructional strategies for the transition of the software to traditional curricular materials and methods;
2. To conduct formative evaluation research and empower teachers as leaders to investigate the effectiveness of the software implementation;
3. To develop peer training activities that enable the teachers as researchers to share their findings and instructional methods with their peers;
4. To disseminate the results of the research.

The plan consists of having four faculty members from North Carolina State University work collaboratively with high school mathematics teachers who have been identified locally as expert teachers. The team meets for two weeks during the summer for initial investigations and this is followed by monthly meetings throughout the year. The work at first is to focus on the potential that software offers to the existing curriculum. Seven of the lead teachers were involved in an initial pilot study and they have experience with the software. They will serve as resource teachers for the other teachers in the study, for a total of 27 initial participants. The team will develop materials to provide the interface between the computer software and the traditional textual materials and then share the results of the project activities with other teachers in their districts. The research methods will be used to evaluate the results as well as to analyze learning styles in light of the infusion of technology.

FACULTY ENHANCEMENT

John S. Risley	USE 8850362
North Carolina State Univ	FY88 $116,400
Raleigh, NC	Physics

"The Conference on Computers in Physics Instruction"

This grant will provide partial support for a conference on the use of computers in teaching Physics. The conference will be held at North Carolina State University, Raleigh, North Carolina, during the week 1-5 August 1988. Attendees will be teachers of physics, both pre-college and undergraduate. Topics will include teaching strategies using computers for classroom demonstrations and student activities, computer-assisted instruction including tutorials and simulations, microcomputer-based laboratories, hardware and interfacing, programming languages, and computational tools.

In addition to the NSF funds, the conference will be supported by about twice the amount from other sources.

COLLEGE SCIENCE INSTRUMENTATION

Jose J. D'Arruda	USE 8852017
Pembroke State University	FY88 $14,665
Pembroke, NC	Physics

"Contemporary Data Acquisition Methods in Science Laboratories"

This project provides for purchase of microcomputers, associated computer peripherals, and physics apparatus. This equipment will be used to improve instruction in the Introductory Physical Science Laboratory course. The students, many of whom are prospective teachers, will learn the fundamentals of computer assisted data acquisition and analysis.

The grantee will match the NSF award with an equal amount of funds.

PROGRAM ASSESSMENT

Jutta P. Sebestik OSPA 8850884
Research Triangle Institute FY88 $227,519
Research Triangle Park, NC Studies

"Follow-up to the 1985 Survey of Science and Mathematics"

The proposed follow-up to the 1985 national survey, to be conducted jointly by RTI and Horizon Research, Inc., will determine the proportion of 1985 science and mathematics teachers who are still in teaching, investigate the reasons that others have left, and determine the likely effectiveness of various incentives for reducing attrition in the science and mathematics teaching force.

Data from the 1985 survey will be used to determine if attrition is more extensive for particular groups of teachers (e.g., those in urban areas, those with better course background preparation, or those who have only a few years teaching experience). The immediate result of this research will be a better understanding of the extent of science and mathematics teacher attrition and the factors, including salary levels, that affect decisions to leave teaching.

STUDIES AND ANALYSES

Iris R. Weiss OSPA 8554471
Research Triangle Institute FY85 $232,431
Research Triangle Park, NC FY87 $ 1,419
Services

"Development of Options for Managing NSF/SEE Middle School Science Programs"

The Research Triangle Institute (RTI) has developed a range of options for managing the middle school science education programs of NSF's Directorate for Science and Engineering Education. RTI has been assisted by two subcontractors, the Education Commission of the States (ECS) and Northwest Regional Educational Laboratory (NWREL) and by an advisory panel of science educators. The purpose of the project is to:

(1) identify problems and opportunities in middle school science education;

(2) describe a series of management options for NSF; and

(3) develop a framework for assessing the quality and impact of NSF's activities in these areas.

COLLEGE SCIENCE INSTRUMENTATION

David W. Hollar, Jr. USE 8852752
Roanoke-Chowan Technical Col FY88 $5,749
Ahoskie, NC Biology

"Computer-Interfaced Instrumentation for an Undergraduate Environmental Science Laboratory"

The Science Department at this small, rural Community College is introducing environmental science-related computer-interfaced instrumentation into relevant science course offerings in its Associate degree programs. The project serves primarily minority and underprivileged college students from the Upper Coastal Plain Region of northeastern North Carolina, providing these individuals with an unprecedented science exposure.

Computer-interfaced environmental science experimentation provides opportunities to make precise measurements of chemical and physical processes relevant to environmental changes (e.g., climate, air and water quality, water and soil pH, optimal plant growing conditions, etc.). This project also provides capabilities for monitoring simultaneous experiments, storage and detailed analysis of data, experimental simulations, and student design of experiments. Finally, the revisions to the curriculum this project is making possible provide students with an exposure to science and to computer applications in science, enhancing their long-term ability to perform effectively in an advanced technological society.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

YOUNG SCHOLARS

Vinetta Jones RCD 8850116
University of North Carolina FY88 $282,762
Chapel Hill, NC Other NEC

"MSEN Summer Scholars Program"

The University of North Carolina Mathematics and Science Education Network (MSEN), 1988 Summer Scholars Programs is a major component of MSEN's Pre-College Program in mathematics and science for historically underrepresented students. The MSEN Pre-College Program is an academic enrichment program that has its goal graduating minority and female students from high school with sufficient interest and preparation in mathematics, science and English to pursue math or science based fields at the university level.

Summer Scholars Program activities are offered to 320 junior and senior high (grades 7-12) minority and female students at four campuses within the statewide UNC System.

The Summer Scholars Program is an integral component of the MSEN Pre- College Program through which participating students receive intense, experiential earning activities in mathematics, science and communications through small group and individual interaction. The Summer Scholars Program involves parents, teachers, and business and university scientists and engineers in the students development.

Each Summer Scholars Program consists of four courses that meet daily for one hour--mathematics, science projects, communications, and instrumental enrichment--as well as field trips, meetings with university and business scientists, and programs involving parents. The courses are academically intensive, challenging and enriching supplements to regular school-year courses. These courses enable students to improve and refine their knowledge and skills with individual and group instruction from teachers, participation in laboratory and field work, interaction with business and university scientists and engineers, and through team approaches to learning.

COLLEGE SCIENCE INSTRUMENTATION

Charles A. Bennett, Jr. USE 8750195
Univ of North Carolina Asheville FY87 $8,700
Asheville, NC Physics

"Microcomputers for Introductory and Advanced Undergraduate Physics Laboratories"

A system of microcomputers will be used to enhance the general physics curriculum at the University of North Carolina, Asheville and to provide physics majors with experience in data acquisition, analysis and control. A set of four microcomputers equipped with scientific graphics and analysis software will be integrated into the laboratory portion of all introductory physics courses. A fifth microcomputer, equipped with data acquisition hardware and software, will be used to increase the extent to which computer data acquisition and control techniques are used by physics majors in the junior level experimental physics course. The main computer will also be used by students in upper level physics courses as well as senior research projects.

COLLEGE SCIENCE INSTRUMENTATION

Tracy L. Brown USE 8750369
Univ of North Carolina Asheville FY87 $13,746
Asheville, NC Computer Science

"Advances in Research Methods Education: Computer Applications in Design, Analysis, and Interfacing"

The efficient preparation of undergraduate students to benefit from participation in scientific research is a growing concern at the institution. The project is enhancing undergraduate readiness for participation in research by providing more efficient, comprehensive, and modern instruction in research methods. Using a network system of nine microcomputer lab stations, students are working with instructional programs and statistical software covering the areas of research design, statistics, and computer interfacing. By providing direct statistical analysis, both fundamental and advanced concepts in research methods can be taught more efficiently and thoroughly than is possible in more traditional research programs. In addition, the project is covering the uses of computers in research settings, providing students with both conceptual and practical knowledge relevant to contemporary research methodology. The program should provide a model for other institutions committed to undergraduate research.

COLLEGE SCIENCE INSTRUMENTATION

Charles G. James USE 8852645
Univ of North Carolina Asheville FY88 $29,576
Asheville, NC Chemistry

"Modernization of Experiments and Expansion of Undergraduate Instrument Techniques with an FTIR Spectrometer"

A Fourier Transform Infrared Spectrometer (FTIR) is giving the students hands-on experience with modern infrared instrumentation and current infrared sampling techniques. With the spectrometer's integral computer the students are being exposed to computer controlled instrumentation and computer analysis of data earlier in their course work. The principles introduced by exposure of students to the FTIR are forming the basis of explanation of other instruments using transform methods or which are interfaced to computers. The spectrometer with its accessories is allowing the students to expand their analysis experience with mixtures, opaque solids, powders, and surfaces using reflectance techniques. The aqueous liquid cell is making possible the routine vibrational analysis of aqueous solutions. Current experiments in the department are being modified and new experiments are being produced for undergraduate students which are taking into account the capabilities of an FTIR spectrometer, computer analysis of spectra and reflectance techniques for analysis. The range, sensitivity, and resolution of the instrument is also being used by students doing undergraduate research in organometallic synthesis and molecular structure.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Wayne Lang USE 8750237
Univ of North Carolina Asheville FY87 $12,732
Asheville, NC Computer Science

"An Undergraduate VLSI Design Workstation Laboratory"

This project will make innovative use of the microwave network being installed by the State of North Carolina to link the Asheville campus to the North Carolina Microelectronics Center. Using IBM PC AT's as workstations, students will be able to use the computing power of the Center remotely. Thus, at modest cost, fairly sophisticated design can be done at the undergraduate level in this emerging field.

COLLEGE SCIENCE INSTRUMENTATION

Robert G. Aitken USE 8750361
Univ of North Carolina Charlotte FY87 $13,155
Charlotte, NC Physics

"Upgrade and Computerization of Undergraduate Solid State Laboratories"

The University of North Carolina at Charlotte is in the process of implementing a microelectronics program. Interdisciplinary and team-taught courses in solid state physics and in semiconductor device physics are being established jointly by the departments of Physics, Electrical Engineering, and Mechanical Engineering and Engineering Science. These lecture courses are being supported by laboratory courses in both subjects, and they are to be required for all engineering students opting for a major in microelectronics. A dedicated computer and data acquisition system will be acquired for the laboratory which supports both of these courses; a programmable lock-in amplifier will also be used in several of the experiments. These instruments will create a fully modern laboratory where students will gain experience in modern data acquisition techniques, as well as in the principles of solid state physics and of semiconductor device physics.

COLLEGE SCIENCE INSTRUMENTATION

Robert G. Aitken USE 8852056
Univ of North Carolina Charlotte FY88 $10,265
Charlotte, NC Physics

"Raman Spectroscopy for an Undergraduate Solid State Physics Laboratory"

In order that existing Solid State Physics lecture and laboratory courses may be kept abreast of new developments, the Physics Department will add a Raman spectroscopy experiment to the laboratory course. This will add capability in the optical study of solids and builds upon the modest amount of optical equipment which already exists. The instrumentation to be acquired can itself be expanded upon later to add experiments involving other optical techniques such as Brillouin scattering and fluorescence.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

R. Janardhanam USE 8852316
Univ of North Carolina Charlotte FY88 $40,225
Charlotte, NC Civil Eng

"Comprehensive Geotechnical Engineering Laboratory."

This project exposes Civil Engineering students to a comprehensive geotechnic engineering laboratory that integrates computers into laboratory experiments. The computer integration involves real-time data acquisition from and control of a collection of instruments. The lab equipment includes: pressure permeater, temperature controlled freezing and thawing chamber, extensometer, cyclic triaxial cell, interfaced microcomputer and various sensors and transducers.

This laboratory not only enhances existing experiments in Geotechnic Engineering but also permits students to carry on studies in new areas such as: examining the migration of pollutants through soils and performing 3-D testing of soils.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

G. P. Mohanty USE 8750412
Univ of North Carolina Charlotte FY87 $41,773
Charlotte, NC Mechanical Eng

"Undergraduate Laboratory Enhancement Through Computer Interactive Experimentation"

Under this project, the junior mechanical engineering laboratories will be enhanced with the addition of interactive computer control of experiments. Experiments in three major stems of the program are envisioned. They are mechanics/materials, thermal/fluids, and systems/controls. In the materials area, the student will be introduced to materials analysis techniques, the recording of x-ray diffraction patterns and their interpretation in terms of appropriate structural parameters. In the fluids area, measurements will be made in a duct of velocity and pressure drop distribution using computers to control fan speed and positioning of the pitot tube across the duct cross section.

In the systems area, computer controlled experiments will demonstrate various ways to control an air engine and coupled tanks.

COLLEGE SCIENCE INSTRUMENTATION

Edgar G. Munday	USE 8852841
Univ of North Carolina Charlotte	FY88 $6,750
Charlotte, NC	Mechanical Eng

"Microprocessor Interfacing for Undergraduates in Mechanical Engineering"

This project introduces undergraduate Mechanical Engineering students to microprocessor interfacing. The student's skills for designing experiments are enhanced by the ability to interface the microprocessor to basic engineering sensors and components such as strain gages, thermocouples, LVDT's and stepping motors. The laboratory equipment that supports this project consists of microprocessor trainers, analog interfaces and associated software.

This laboratory familiarizes students with modern techniques of measurement.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Suzanne M. Lea	TPE 8470438
Robert B. Muir	FY85 $269,548
Gaylord T. Hageseth	FY87 $ 3,198
Univ of North Carolina Greensboro	Physics
Greensboro, NC	

"Project ARCHIMEDES: Applications, Reasoning, and Concepts for High School Instructors: Making Educational Discoveries and Expanding Skills"

The purpose of this supplemental grant is to extend the University of North Carolina at Greensboro's institute of physics and physical science for high school teachers to include elementary school teachers. This five-week summer pilot component will investigate the response and conceptual understanding of elementary school teachers to physics curriculum designed for high school teachers. It will focus on misconceptions and preconceptions in physics, and which teaching methods can be used to identify and overcomes these misconceptions.

This physics institute, Project ARCHIMEDES, an NSF project of UNC at Greensboro, consists of two fifteen-month cycles of activities which include the teaching of physical science concepts, problem-solving skills, electronics and microcomputers.

The principal investigator is a physics educator who has extensive experience and knowledge of the research in material development and implementation.

COLLEGE SCIENCE INSTRUMENTATION

Lawrence G. Kolenbrander	USE 8851879
Bruce D. Idleman	FY88 $38,367
Western Carolina University	Geology
Cullowhee, NC	

"Geographic Information System Laboratory for Undergraduate Instruction"

A Geographic Information System (GIS) Laboratory is established to improve the quality of undergraduate instruction in the Natural Resources Management and Earth Sciences Programs. The laboratory includes three workstations, ancillary hardware and GIS software in two formats (vector-based and raster-based) in common use. Junior and senior level students are applying GIS to problems in the fields of Natural Resources Management, Geology, Geography and Planning. GIS is used to obtain and manipulate special information, and the interpretation and synthesis of this information. GIS allows students to address research problems that normally require inordinate amounts of time and effort to answer using traditional techniques of special analysis such as manual overlays. The use of GIS technology is becoming increasingly common in the fields affected by this award. This new laboratory enhances the problem solving, research, and professional capabilities of graduates from the respective programs.

The award will be matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Charles J. Martin	TPE 8652290
J.Ralph DeVane	FY88 $369,899
Joseph B. Klerlein	Computer Science
Judith Clauss	
Western Carolina University	
Cullowhee, NC	

"Honors Institutes in Computing for Precollege Teachers"

This state/academia partnership will develop a three-year honors institute in computing which will offer intensive summer residential activities and academic-year follow-up for 30 southeastern teachers, grades K-12. The goals are to:

- prepare master teachers to meet certification requirements to (1) incorporate use of computers into content area instructions; and (2) become a computer technology specialist in the school system;
- create a resource pool of leader teachers who will hold in-service workshops for their colleagues.

The academic courses, which include experience with microcomputers especially designed for the teachers, are (1) Utilities; (2) LOGO; (3) BASIC; (4) Applications to K-8 Curricula; (5) Computer Concepts in Programming; (6) Data Structures; (7) Applications to High School Curricula. The K-8 teacher will take courses (1) through (4); high school teachers will take (1) through (3) and (7); while Advanced Placement programming teachers will take (1) through (3), (5) and (6). Courses will be offered during six weeks of the summer and bi-weekly meetings on Saturday during the academic year for the local teachers. In the two academic years, monthly on-site visits to in-state teachers will be made. There will also be a computer network and newsletter for all participants. Moreover, ten workshops per year will be held by the lead teachers, who will be given released time by their schools so that they may help colleagues meet certification requirements. Academic credit will be awarded by Western Carolina University (WCU) for those who complete the work.

COLLEGE SCIENCE INSTRUMENTATION

Hedy White USE 8750204
Scott Minor FY87 $6,717
Western Carolina University Psychology
Cullowhee, NC

"Expanding Experimental Psychology Laboratory: A Three-Field Tachistoscope for Enhancing Undergraduate Research and Courses in Human Information Processing"

This project is enhancing undergraduate training in experimental psychology. A three-field tachistoscope, with automatic card changers and reaction time apparatus for key-press and voice responses, is being used to expand laboratory assignments and original research projects in areas of human information-processing that have used basic paradigms involving timed presentation of visual stimuli. The project is serving undergraduates, primarily psychology majors (70% of whom are women), enrolled in the following courses: Sensation and Perception; Learning, Memory, and Cognition; Language and Thought; General; Research Methods; and Projects (i.e., faculty-supervised independent research). Students will use the tachistoscope in conducting laboratory replications of experiments demonstrating important concepts (e.g., masking in iconic memory, semantic priming) and in conducting original research investigating human information-processing theories. Increasing undergraduate experience in scientific research is intended to encourage graduates to pursue doctoral training in experimental psychology.

NORTH DAKOTA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Michael T. Burton
Science
Agassiz Junior High School
Fargo, ND

James E. Lundstrom
Mathematics
Mandan High School
Mandan, ND

1988

Catherine McDermott
Mathematics
Surrey Public School
Surrey, ND

Richard J. Swanson
Science
West Fargo High School
West Fargo, ND

COLLEGE SCIENCE INSTRUMENTATION

John F. Brauner USE 8750255
Jamestown College FY87 $47,692
Jamestown, ND Biology

"Undergraduate Biology & Chemistry Equipment for Upgrading Course Laboratories and Student Research Opportunities"

The new instructional equipment procured through this project is raising the quality of nearly every course taught in the Biology and Chemistry Departments. This wide-spread impact results from the way it is enhancing the laboratory experience so that the experimental skills and techniques developed by these students are better matched to the high level of theoretical training they traditionally have received here. The degree of change varies among the courses, with the greatest initial improvements being seen in the upper-level courses and in the Junior- Senior Research Seminar experience.

The new equipment has been selected for maximal student utilization, as well as for its relevance to modern technology. Student interest in the sciences is finding strong reinforcement through their greatly increased opportunities to actually engage in scientific laboratory work, rather than merely hearing about it in the lecture hall.

INSTRUCTIONAL MATERIALS DEVELOPMENT

William A. Dando	MDR 8470308
Douglas C. Munski	FY85 $202.579
University of North Dakota	FY87 $ 40.000
Grand Forks, ND	Atmospheric

"Pre-College Earth Science Meteorology and Climatology Materials"

While no branch of earth science is supposedly less important than the other, physiography, geomorphology, and paleontology have been the focal point and the primary topics covered in most earth science classes. In a space age, generations of students are lacking critical knowledge of the earth's atmosphere, the geography of space, and the modern principles of meteorology and climatology. This project addresses the need to increase teacher capabilities, to improve instruction, and to enhance student understanding and appreciation in "earth science meteorology and climatology" through the development of superbly designed and classroom tested scientific teaching materials, future-oriented computer programs, space-age student workbooks, etc. The goal is to produce prototypes of weather and climate materials for possible national use, and provide proof that in a wide range of classroom environments with culturally diverse students the materials would indeed be useful. Active teachers, scientists, science educators, officials of state and local education agencies, and book publishers will be involved in all aspects of the project including inventory of specific needs for diverse classroom environment, evaluation and testing of materials and lesson plans, and determination of nation-wide utility.

During a second phase of the project, research and development will take place to produce an additional eight lesson curriculum materials package. These materials will provide a transition between the meteorology/climatology component of earth science and the astronomy component using a space science approach.

This materials development project is filling a national need for a student age level where few effective science education programs exist, the middle/junior high school level. Secondly, the project is involving research scientists in cooperation with precollege science teachers and publishers. The involved scientists are noted in the areas of geography, computer science and remote sensing.

OHIO

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Richard D. Heckathorn
Science
Midpark High School
Cleveland, OH

Susan E. Macintyre
Mathematics
Walnut Hills High School
Cincinnati, OH

1988

Robert Seitz
Mathematics
John Adams High School
Cleveland, OH

Mark A. Carle
Science
University School
Chagrin Falls, OH

TEACHER ENHANCEMENT PROGRAM

Cynthia Stong-Groat	TPE 8751786
William E. Evans	FY88 $143.370
Claudia T. Melear	FY89 $145.907
Bowling Green State University	FY90 $155.235
Bowling Green, OH	Biology

"An Ocean Focus for Science Teacher Enhancement"

This project features the ocean as a focus for science teacher enhancement. Bowling Green State University has the unique facilities including an inland Marine Laboratory which provides the local site and expertise. This three-year project will provide an opportunity for 120 elementary, middle, and high school science teachers to study the marine environment at the University laboratory, as well as at the Sea Worlds of Ohio and Florida, and compare and correlate it to the freshwater ecology of the area. The National Marine Fisheries Service is an additional supporter, both programmatically and financially, of this project.

All teachers will study oceanography and marine biology in the spring prior to the two-week summer study and field trips. The latter will include trips to Lake Erie for the nearby freshwater environment and to Orlando and Long Key in Florida to study the salt water environment. Marine habitats will be observed and live specimens will be collected for classroom aquaria. Teachers will be instructed in the care and maintenance of the aquaria and school districts have indicated support for their purchase and upkeep.

A unique opportunity exists with this project not only to enhance the teachers in an area of science with which they are not familiar, but to provide a focus for career information to students who have no direct connection with the oceans. The new knowledge, experiences, and materials should improve the quality of science teaching. Numerous science disciplines can be interrelated through ocean study. This can create an increased awareness among teachers and students of the ocean's impact on inland residents and a renewed understanding of the interrelatedness of many areas of science.

TEACHER ENHANCEMENT PROGRAM

John D. McGervey TPE 8652413
Case Western Reserve University FY87 $44,487
Case Institute of Technology Physics
Cleveland, OH

"Retraining Program in Physics for High School Teachers"

The P.I. and a staff of three master secondary school physics teachers will offer an intensive three-week course of instruction focusing on topics in physics and physical science. The instructional format includes lectures, laboratory work, and group discussions. During the following academic year, the P.I. will visit each participant in his or her home school. In addition, there will be monthly meetings of all project participants held at various locations throughout northern Ohio and a full weekend program at Case Western Reserve University.

The participants will be 25 middle school and high school physics or physical science teachers. They will be selected from among a significant number of physics teachers in northern Ohio who need upgrading in their knowledge of fundamental principles of mechanics, wave motion, optics, thermal physics, electricity and magnetism, and nuclear radiation.

The evaluation plan calls for:

(1) subject matter testing of the participants;

(2) questionnaires exploring the opinions of participants about the match between their needs and program emphases;

(3) questionnaires administered at the end of the project year that evaluate the project's impact on the participants' students;

(4) evaluations by supervisors of the participants.

INFORMAL SCIENCE EDUCATION

Sandra L. Toombs MDR 8751453
H.Gregory McDonald FY88 $123,970
Cincinnati Museum of Natural History FY89 $114,770
Cincinnati, OH FY90 $110,400
Geology

"Cincinnati: The Pleistocene Legacy"

The Cincinnati Museum of Natural History is moving from a long established site to a new 175,000 square foot facility in a rehabilitated downtown railway station. The opening permanent exhibition, "Cincinnati: The Pleistocene Legacy," will comprise 20,000 square feet of natural history exhibits that present in depth the geologic, climatic, and biological phenomena of the Ice Age in Ohio. In addition to large scale, dramatic "walk-through exhibits" and dioramas and substantial use of collections, a large number of interactive exhibit components will illustrate different features of the Pleistocene period. NSF support will be concentrated on these interactive components and on work to insure effective handicapped access for the entire exhibit. This highly regarded project will cost $2.8 million, matching NSF funds seven times over. It will generate an annual audience of 875,000 visitors including more than 120,000 school group visitations.

PRIVATE SECTOR PARTNERSHIPS

Barbara H. Patterson TPE 8751541
The Cleveland Education Fund FY88 $191,916
Cleveland, OH FY90 $208,190
Mathematics

"Problem Solving Infusion Project"

The Cleveland Collaborative for Mathematics Education, a program of the Cleveland Education Fund, will develop and implement over a four-year period a curriculum and professional development model which will upgrade the Cleveland Public Schools' seventh and eighth grades mathematics curriculum to incorporate problem solving. The Problem Solving Infusion Project will: 1) establish an accurate working definition of problem solving and convey the integral relationship of problem solving and mathematics to the Cleveland Public Schools intermediate school teachers; 2) develop a format for the presentation of problem solving activities that will aid teachers in the development of problems and in the incorporation of problem solving into the classroom; 3) produce a set of teacher-developed problems correlated to the course objectives that will then be tested in an urban setting with a predominately minority school population; 4) develop and implement a staff development model that will assist teachers in using new curriculum materials and in expanding their teaching techniques; 5) develop a problem solving community computer network which will facilitate networking and aid in the formulation and dissemination of curriculum materials; and 6) establish a contest format that can be implemented in districts throughout the country.

Cost sharing by the partners will total 80% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Shila Venkataraman	USE 8851515
College of Wooster	FY88 $20,835
Wooster, OH	Physics

"A Laser Optics Laboratory for Undergraduate Projects"

An optical laboratory will be assembled that will illustrate many important concepts in Optics, allow testing of the theories developed in courses, and provide crucial experimental techniques for probing condensed matter systems. All students are required to perform a year-long research project in their senior year. An extended investigation allows students to integrate material from a variety of courses and labs and provides an essential example of their profession. This grant will allow a new technique to be available for student research - laser light scattering. By providing a series of optics experiments in modern Physics and junior independent study, the students will be able to use static and dynamic light scattering as a probe of many physical systems currently of interest to the scientific community. The acquisition of a 5 W Argon ion laser, a vibration isolated optics table, laser amplitude stabilizer and several optical components will allow our undergraduates to investigate fundamental molecular processes and to do holography in laboratory courses and in senior independent study projects.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Robin L. Bartlett	USE 8750174
Denison University	FY87 $30,173
Granville, OH	Economics

"Improving Undergraduate Economic Instruction with a Computer Laboratory"

This project is enhancing the science education of students enrolled in Economics by introducing computer-assisted experiments that supplement traditionally presented materials in such courses as Principles of Economics, Micro and Macroeconomic Theory, and Econometrics. The computers also add great flexibility to the treatment of topics studied in the Senior Seminars. The mix of technologies now available takes advantage of the computational and graphic capabilities of each machine, allows programming flexibility for the future, and fully utilizes the developing computer expertise of the faculty.

Economics instruction is greatly improved by bringing the computer into the classroom, thus allowing students to run regressions, to make forecasts, and to simulate policy outcomes with the instructor nearby. Selected software includes Formodel 1000 for both the Macroeconomics and the Money and Banking labs, and SHAZAM for Econometrics. Moreover, this new laboratory approach to teaching Economics makes students intensely aware of integral part that computers and scientific experimentation play in the professional lives of present day economists. With its new suite of computing equipment, the laboratory is able to accommodate sections of up to thirty students.

COLLEGE SCIENCE INSTRUMENTATION

William A. Hoffman, Jr.	USE 8750741
Thomas A. Evans	FY87 $21,150
Denison University	Chemistry
Granville, OH	

"FTIR Instrumentation for Undergraduate Instruction"

The development of Fourier Transform Infrared (FTIR) Spectroscopy has transformed the investigation and characterization of materials by infrared spectroscopy. The recent acquisition of FTIR instrumentation by the Chemistry Department at Denison University is providing undergraduate students with experience in the qualitative and quantitative applications of FTIR at all levels of the curriculum. The instrument's superior resolution, output flexibility, and capacity for searching spectral data bases allows students to work on problems ranging from polymer film analysis by non-science students to the characterization of novel oxidized porphyrins by senior research students.

COLLEGE SCIENCE INSTRUMENTATION

Zaven A. Karian	USE 8750137
Denison.University	FY87 $36,000
Granville, OH	Mathematics

"The Use of Computer Algebra Systems in Teaching Introductory Calculus"

This project will enhance lower-division students' understanding of the basic concepts of calculus and increase the likelihood that these concepts will be properly applied in new situations. The project will incorporate the use of a Computer Algebra

System (CAS) to carry out complex computational and symbolic operations, thereby freeing time for students to better understand and apply the rich collection of ideas embodied in calculus. Many applied mathematicians and engineers have used CAS in their work, but the computer power required to sustain CAS has, until recently, prohibited its use in most academic environments. Denison University will purchase two Micro VAX II computers with 20 attached terminals on which to run Maple, a CAS software package. This configuration is well within the capability of the faculty and one that meets the needs of the students. This project is especially important now, when many mathematicians are calling for attempts to make calculus more "lean and lively" and to interest more students in mathematics.

TEACHER ENHANCEMENT PROGRAM

Craig L. Moser TPE 8751880
Hiram College FY88 $158,072
Hiram, OH Other NEC

"Hiram Summer Scholars"

Hiram Summer Scholars is a three-week summer educational enrichment program to promote excellence in the natural sciences, mathematics, problem solving and computer science in upper elementary and middle school classrooms throughout the Hiram, Ohio region. In each of two summers, forty teachers will choose among five three-week sessions taught by Hiram College science and mathematics department faculty; participants will receive academic credit for this work. During the middle week of the program, 100 disadvantaged students from the participants' schools will take part in model classrooms taught by the participants with funds made available as cost-sharing from the indirect cost for this grant.

During the academic year, participants will have three additional meetings as well as access to the campus facilities, which include an observatory and biology field station. Hiram College faculty will visit participants' classrooms as guest lecturers and to assist in sharing new information.

COLLEGE SCIENCE INSTRUMENTATION

Dennis J. Taylor USE 8750865
Hiram College FY87 $22,389
Hiram, OH Biology

"Instrumentation for Undergraduate Studies of Physiology, Endocrinology, Cellular and Molecular Biology"

Student laboratory opportunities in Molecular and Cellular Biology, Endocrinology and Physiology are being enhanced, and increased opportunities for undergraduate research and internships are being provided through the purchase of needed instructional instruments. Renovated cell culture and endocrinology laboratory facilities as well as new instrumentation for enzyme-linked immunosorbant assays, cell culture, high pressure liquid chromatography, and spectrophotometry are providing significant links between students' laboratory and field experiences in whole organismal biology at the College's field station and their laboratory experiences in Cell Biology, Physiology, Microbiology and Endocrinology on campus.

Increasing student understanding of both the potentials and the limitations of blood screening procedures also is being gained by non- majors through use of the enzyme-linked immunoassay equipment procured under this award. Such socially relevant laboratory experience is an important aspect of education for non-scientists who will be decision makers in a technology-based society.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Douglas H. Clements MDR-8651668
Michael T. Battista FY86 $330,201
Kent State University FY88 $228,442
Kent, OH Mathematics

"Development of a Logo-based Elementary School Geometry Curriculum"

In the current elementary school curriculum, little attention is devoted to developing students' geometric problem solving abilities, spatial thinking, or ability to analyze and reconceptualize substantive geometric ideas. Use of the Logo computer language has the potential of transforming both the content and method of the elementary school geometry curriculum.

This project will develop a new geometry curriculum for use in elementary schools and will create a set of Logo based classroom activities that promote the objectives of the curriculum. Expected outcomes will include a set of instructional materials, a book for teachers, recommendations for teacher training, and a videotaped program that will include exemplary lessons taught by teachers involved in the field test.

COLLEGE SCIENCE INSTRUMENTATION

Dorothy E. Jegla USE 8750368
Kenyon College FY87 $13,683
Gambier, OH Biology

"Equipment for Teaching in Vitro Plant Tissue and Organ Culture Techniques to Undergraduates"

Laboratory exercises incorporating plant in vitro culture techniques are being developed in the Plant Sciences. These exercises require the use of culture chambers to maintain the cultures for such specific exercises as corn embryo development

(Introduction to Experimental Biology): isolation and culture of the carnation shoot apex (Plant Biology): and leaf disc transformation of tobacco using Agrobacterium tumefaciens (Plant Biology). The culture chambers also are being used for student Honors and Independent Research projects, as well as for the laboratories associated with courses in Plant Physiology and Molecular Biology.

COLLEGE SCIENCE INSTRUMENTATION

R. Lester Anderson USE 8852995
Marietta College FY88 $30,500
Marietta, OH Physics

"Using Sensors and Microcomputers to Simplify the Learning of Concepts in the Introductory Physics Laboratory"

The grantee institution will purchase electronic sensor sets, rotational dynamics apparatus sets, microcomputers and associated peripherals and software. This equipment will be used to improve instruction in lower-division Physics Laboratory courses. Improvements will be made to nine basic experiments in these courses, and students will have the opportunity to enhance their understanding of the underlying physical phenomena through the use of modern sensing equipment and data analysis techniques.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Hans-Georg Gilde USE 8851498
Marietta College FY88 $11,537
Marietta, OH Chemistry

"Fourier Transform Infrared (FTIR) Spectroscopy in Undergraduate Chemistry"

The upper-level Chemistry Laboratories are being improved by the incorporation of Fourier Transform Infrared methods. The Chemistry courses which are using the new FTIR are Molecular Spectroscopy, Physical, Advanced Inorganic, Instrumental Methods of Chemical Analysis and Biochemistry. In addition, two chemically-oriented courses in geology (Mineralogy and Petrology are using the FTIR. Compared to the dispersive IR instruments used previously, the FTIR provides better resolution, higher sensitivity and superior performance in the far IR region. While it is difficult to use dispersive IR for the analysis of impure liquids and solids, the FTIR (and its diffuse reflectance and multiple internal reflection accessories) are permitting students to gain hands-on experience with more modern analytical techniques, including mixture analysis and solution chemistry. Furthermore, students are becoming acquainted with the mathematical manipulations and computer methods involved in Fourier Transform techniques. As a result of this project, students are better prepared for graduate school and careers in industrial laboratories.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Larrie V. Hutton USE 8750596
Marietta College FY87 $22,005
Marietta, OH Computer Science

"Providing Expert System Development Tools to Undergraduate Students"

The purpose of this grant is to provide expert system development tools to students in an undergraduate course in artificial intelligence (AI) at Marietta College. These tools will provide students with the means to develop programs that are able to apply the rules used by human experts when they solve problems. The Compaq 80386 computers and the OPS5+ expert development system used in this grant will give students practical experience in the design and implementation of an expert system. The project chosen for this class is the development of a system that may help mental health practitioners to differentiate between clients with schizophrenia, which is a serious (psychotic) mental disturbance, and various forms of personality disorders, which are less serious. This distinction is often a difficult one for psychologists and psychiatrists to make accurately. Students will be able to evaluate the validity of their system by comparing the diagnoses produced by the expert system to those of professionals in the field.

YOUNG SCHOLARS

Jnanendra K. Bhattacharjee RCD 8850089
Miami University Oxford Campus FY88 $35,917
Oxford, OH FY89 $35,917
Life Sciences

"Summer Enrichment in Molecular Biology and Recombinant DNA Technology"

Miami University, Oxford Campus conducts a summer enrichment program in molecular biology and recombinant DNA technology for high school students as Young Scholars. Twelve students who have completed their junior year are selected from the high schools of Ohio, Indiana, and Kentucky. Young Scholars spend six weeks during the summer in residence at Miami University. Students attend formal lecture presentations and research seminars in the morning, Monday through Friday, and perform research experiments in molecular biology research projects in the laboratories of selected faculty research mentors from the Botany, Microbiology, and Zoology Departments in the afternoons. Additionally, Young Scholars attend informal seminars on career opportunities in molecular biology, on the college admission process, and the scientific ethics, risk, and social responsibilities of recombinant DNA researchers. Miami's residence hall staff arranges different social, cultural, and sports activities for the Young Scholars.

COURSE AND CURRICULUM

Thomas A. Farmer, Jr USE 8813786
Frederick Gass FY88 $48,595
Miami University Oxford Campus Mathematics
Oxford, OH

"Toward a Conceptual and Captivating Calculus"

The objective of this calculus planning grant at Miami University in Ohio, is to develop a lean and lively calculus syllabus for college students who have had calculus in high school. After consultation with scientists from client disciplines on the current uses of calculus, materials incorporating computers will be developed to run a preliminary experiment. At the end of one year, a large scale controlled experiment with teaching and computing materials will be ready.

Miami University will co-fund over a third of the project. This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

TEACHER ENHANCEMENT PROGRAM

David E. Kullman TPE 8751738
John H. Skillings FY88 $89,631
Miami University Oxford Campus Mathematics
Oxford, OH

"Statistics for Secondary School Teachers"

This two-year project will develop materials to prepare middle and high school mathematics teachers to teach statistics and will use these materials in a five-week summer session for 30 teachers from the region around Oxford, Ohio. Designed as a supplement to standard college-level statistics texts, these materials will offer, at an adult level, the kinds of experiential approach to statistics that is currently emphasized in many secondary school texts. The five modules will cover descriptive statistics and data analysis, elementary probability, probability distributions, elementary inference, and advanced inference.

Follow-up activities include visits by project staff to the participants' schools and a miniconference at the end of the academic year. Evaluation will assess the effectiveness of the materials as well as the participants' success in teaching statistics in their schools. The materials will be disseminated through a series of regional workshops.

The university and the participants' schools will contribute an amount equal to 26% of the NSF award.

TEACHER ENHANCEMENT PROGRAM

Beverley A. Taylor TPE 8751244
John P. Williams FY87 $91,852
Jerry L. Sarquis Other NEC
James E. Poth
Miami University Oxford Campus
Oxford, OH

"Teaching Science with Toys"

Seventy-two teachers, K-12, will participate in a workshop for ten days during the 1988 academic year reviewing scientific principles and participating in hands-on science activities using toys. The teachers will be divided into four groups for instructional purposes: K-3, 4-6, 7-9, and 10-12. Each teacher will present workshops to other teachers in their school district on teaching science through the use of toys. These workshops will be presented on Fridays and Saturdays between September 1987 and April 1988. Teachers will be chosen from several school districts in Southern Ohio. They will design strategies to incorporate these activities into their curriculum and increase the participation of girls in science. The university staff and school personnel will evaluate the effectiveness of this program in the class rooms in 1988.

The participants will be provided with materials to use in their classrooms and to conduct inservice activities. School districts will make commitments to continue this program for at least three years after this program is completed and to provide the support for the local inservice workshops.

The PI and staff are eminently qualified to carry out this program. They engaged in a tremendous amount of pre-planning for this project. The university's commitments to this program are unusually strong.

COLLEGE SCIENCE INSTRUMENTATION

David L. Quinn USE 8853032
Muskingum College FY88 $14,421
New Concord, OH Biology

"Fluorescence Microscope with Computer Linkage to Support Undergraduate Studies in Physiology, Genetics and Anatomy"

The goal of this project is to provide students an opportunity to conduct experiments with biological phenomena at the cellular and molecular levels. The major new equipment includes a Nikon fluorescence microscope-camera system, a cryostat, and computer equipment linked to the fluorescence microscope through a closed- circuit video system for image analysis.

Fluorescence markers are used to study , e.g., human, animal and plant chromosomes, cellular development and brain pathways. Some current student research projects involve the activation of genes in the hippocampus, tracing neural pathways in the brain, verification of success of transplantation of adrenal medulla tissue to the brain, sexual differentiation in the spinal cord, and analysis of muscle cell changes following the administration of anabolic steroids and exercise. The computer equipment is being linked to the fluorescence microscope and image analysis programs written to support the various experimental protocols. Students can explore the molecular basis of life in the laboratory, becoming proficient with equipment that is linked to computer systems while experiencing the increased experimental design and analysis capabilities available through such systems.

This new equipment is enhancing biological laboratory work in Physiology, Genetics and Evolution, Introduction to Biology, and undergraduate student research. The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

PRIVATE SECTOR PARTNERSHIPS

Carol O'Connell	TPE 8851041
Northmont City School District	FY88 $ 60,634
Englewood, OH	FY89 $142,416
	Elem Science

"Project Create"

PROJECT CREATE is a cooperative project of the Northmont, Ohio, City School District and scientists and engineers from local industry and governmental laboratories. It will develop materials and facilities for teaching science in the elementary grades and work with the district's teachers to enable them to effectively utilize the materials in their classes. Once developed and proven in use, the teaching materials will be disseminated through state and national educational organizations.

The district, with strong industrial support and participation, will develop and equip a "micro-tech satellite" -- a room with science equipment and exhibits -- which can be used by all the district's elementary teachers. It will be used for in-service activities for teachers and by the district personnel and industrial/governmental scientists/ engineers who will be developing hands-on science and mathematics curriculum materials to fit the following sequence: Grades K-1, plants: 1-2, animals: 3, environment: 4- 5, earth science: 5-6, physical science.

The use of the partnership concept is intended to insure that both the science and the pedagogy will be sound, up-to-date, and well integrated.

Cost sharing by the partners will total at least 50% of the NSF funding.

TEACHER ENHANCEMENT PROGRAM

Jeanmarie DeChant	TPE 8652399
John Carrabine	FY87 $60,886
Notre Dame College	Chemistry
Cleveland, OH	

"Teacher Development Program for Underprepared High School Chemistry Teachers"

Key to this project is a three-week summer workshop for 24 high school chemistry teachers selected from northeastern Ohio. In this intensive workshop they will study chemical structure and bonding, energetic aspects of chemistry, and biochemistry. In addition, they will participate in a course component in science education. Features of the program include lectures, laboratory exercises, instructions in videotaping science demonstrations, and exposure to computer applications. The program will provide an introduction to the "real world" of applied chemistry through laboratory and industrial tours and lectures by industrial scientists. Problem sets, computer software, and videotaped materials will be tested by the teachers in their classrooms during the following academic year, and the results of these piloting activities will be shared in follow-up Saturday workshops.

The 24 participants will be selected from those with less than five years of chemistry teaching experience at the secondary level and/or those unprepared for chemistry teaching. Special consideration will be given to applicants from the Cleveland school system, to members of under-represented groups, and to teachers of students from under-represented groups. The teachers will receive stipends of $200 per week and their living expenses at Notre Dame will be covered by the grant. They will be eligible to receive academic credit in the form of continuing education units.

COLLEGE SCIENCE INSTRUMENTATION

Susan K. Hill	USE 8853308
Notre Dame College	FY88 $11,126
Cleveland, OH	Biology

"Improved Optical Microscopy to Enhance Undergraduate Biology Laboratories"

The goal of this project is to upgrade the biological and technical training of women undergraduates through the improvement of their light-microscopy laboratory curricula. A major thrust of the project is to enable students to view living organisms and tissues, and to learn modern techniques for the examination and evaluation of living cells, cell processes and structures.

The addition of phase, polarized and fluorescence capabilities, and of stereo and invited microscopes, increases the level of instructional sophistication and significantly upgrades the technical proficiency of emerging students. The new microscopes upgrade the entire departmental curriculum, greatly expanding the range of laboratory experiments available in each laboratory offering, and broadening independent student research program, thus making the women scientists emerging from this Department more competitive in today's competition for graduate school admission and for places in the scientific/technological labor market.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Norman C. Craig	USE 8750723
Oberlin College	FY87 $19,300
Oberlin, OH	Chemistry

"Purchase of a Fourier-Transform Infrared Spectrometer"

A recently acquired Fourier Transform Infrared Spectrometer (FTIR) is being used in the undergraduate chemistry curriculum at Oberlin College. This powerful microcomputer-controlled instrument provides more rapid spectral analysis together with higher resolution than can be obtained even with a research-grade dispersive instrument. Seven courses and 150 students in upper and lower division classes will be directly impacted by the use of this FTIR.

COLLEGE SCIENCE INSTRUMENTATION

Robert Geitz	USE 8851262
Oberlin College	FY88 $37,337
Oberlin, OH	Computer Science

"Computer Graphics for Majors and Non-Majors"

The project introduces both majors in computer science and non-majors to topics in computer graphics through the introduction of two new courses: one for Juniors and Seniors in Computer Science and one for non-majors at an introductory level. The equipment that supports this project includes: SUN 3/60 color workstations; a SUN color monitor, color board and mouse for a file server; a 280 megabyte disk drive; SUN graphics board and enhanced graphics processor; network cabling; and, associated software.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Dennison A. Smith	USE 8750118
Oberlin College	FY87 $14,448
Oberlin, OH	Biology

"Equipment for an Undergraduate Neurochemistry and Neuropharmacology Laboratory"

A novel interdisciplinary Neurochemistry/Neuropharmacology laboratory is being introduced into the Neuroscience curriculum at Oberlin College. The High Performance Liquid Chromatograph (HPLC) is being used to bring better chromatographic techniques into this laboratory. At the same time, improved centrifugation assay techniques are being added. With a tissue homogenizer to produce rapid and uniform cell disruption of large tissue samples prior to HPLC and centrifugation assays, a full array of biochemical research techniques for examining the nervous system is becoming available to this program.

Adding a laboratory in Neurochemistry/Neuropharmacology to the curriculum allows students to apply the knowledge and skills they have acquired in basic Biology and Chemistry courses to issues and problems in Neuroscience; increases the sophistication of undergraduate research that is being undertaken; gives students a broader exposure to the approaches and methodologies currently used in the Neurosciences; attracts to the program students (particularly students with an interest in Chemistry) who previously have had little contact with the Neurosciences, and demonstrates the interdisciplinary nature of research in the Neurosciences.

PRIVATE SECTOR PARTNERSHIPS

Lynn E. Elfner	TPE 8851064
Ohio Academy of Science	FY88 $162,040
Columbus, OH	FY90 $137,960
	HS Science

"The Use of Science and Technology Research Centers as Magnets to Improve Precollege Science and Technology Education"

This project will use Ohio's Thomas Edison science & technology centers as natural magnets to improve science & technology education in grades 7-12. It will (1) stimulate development of student research projects in biotechnology, polymers, and manufacturing sciences; (2) provide opportunities for in-service education of science and mathematics teachers in areas of leading edge technologies; (3) promote participation of teachers and students in educational opportunities provided by science and technology research centers; (4) engage scientists and engineers working in areas of leading edge technologies as role models and subject matter specialists in science and mathematics classrooms; and (5) engage teachers in summer internships in areas of leading edge technologies.

Matched in part by university and industrial support, Ohio's Thomas Edison Partnership Program has committed millions of state dollars to the development of nine centers in Ohio. These centers are focused on research in biotechnology, polymers, welding engineering, manufacturing sciences, materials science, and information technologies. This program will enable students and educators in grades 7-12 to take advantage of existing and developing technology research centers and to consult and share knowledge more closely with practicing engineers and scientists in the private sector. Five specific activities are planned: (1) to publish three science project workbooks, (2) to conduct six in-service workshops; (3) to publish five calendars of events; (4) to develop a visiting scholars program affecting 140,000 students; and (5) to establish fourteen teacher internships.

The partnership consists of five kinds of members: (1) more than 100 local schools in Ohio; (2) public and private school board associations; (3) trade and professional association such as the Ohio Chemical Council; (4) Edison Technology Centers; and (5) corporations and institutions such as Battelle Memorial Institute, Monsanto Company, Ohio Edison, Liebert Company, The College of Wooster, and the University of Cincinnati.

TEACHER ENHANCEMENT PROGRAM

Franklin Demana	TPE 8751353
Alan R. Osborne	FY88 $195,716
Bert Waits	FY89 $300,000
Gregory Foley	FY90 $300,000
Ohio State University	Mathematics
Columbus, OH	

"Mathematics Through Technology: Establishing Concepts and Skills of Graphing and Functions in Grades 9 through 12"

The proposed project is a four-year teacher inservice activity whose primary purpose is to introduce to teachers at 24 different sites, mostly in Ohio, the use of materials that utilize calculators and computers in improving students mathematical performances in dealing with functions, graphing, variables, and generalizing. The materials were developed by the project staff during a previous project. During the first year, the teachers will be identified, be educated in the materials and their use, and receive leadership training. The next two years, the teachers conduct inservice workshops for other teachers in their districts. In the third phase, which will occur during the fourth year, there will be evaluation and dissemination activities. It is anticipated that the immediate effects of the project will extend to over 200 teachers.

YOUNG SCHOLARS

Michael H. Klapper	RCD 8850280
Ann Ackerman-Brown	FY88 $30,610
Ohio State University	FY89 $30,610
Columbus, OH	Life Sciences

"The Ohio State University Young Scholar Program"

The goal of this project is to interest twenty 11th and 12th grade high school students in pursuing laboratory science careers. Students are placed in research laboratories during the summer under the direction of research scientists in the Colleges of Biological Sciences, Mathematical and Physical Sciences and Medicine at Ohio State University. In this ten-week program students have the opportunity for hands-on laboratory experience, attend lectures on scientific ethics, are coursellled on career opportunities in the sciences and their own skills in the laboratory sciences. They are given opportunities to explain to others what they have learned and what they may have added to scientific knowledge. Parents and high school teachers are invited to participate with the students in the program. Students' research experiences and their interactions with faculty, graduate students and other researchers increase their interest and enthusiasm for science.

TEACHER ENHANCEMENT PROGRAM

Arnold E. Ross	TPE 8751310
Gloria Woods	FY88 $265,916
Ohio State University	Mathematics
Columbus, OH	

"Mathematics and Science Teachers - Training for Leadership"

The goal of this project is to work with a group of forty-five accomplished secondary school mathematics teachers who have responsibilities to provide mathematical experiences for gifted secondary school students in their home districts. Topics in advanced mathematics closely related to modern research results will be expounded by world renowned mathematicians in a companion project designed for the high school students and funded from outside sources. The teacher participants attend the lectures and discussion groups and learn about the mathematical topics as well as approaches that they could use in their home districts to offer some of the ideas to gifted students. The participants observe the students in the companion workshop and analyze the interaction between the students and the modern mathematical ideas.

COLLEGE SCIENCE INSTRUMENTATION

Theodore L. Miller	USE 8852693
Lewis Fikes	FY88 $17,547
Ohio Wesleyan University	Chemistry
Delaware, OH	

"A High Performance Liquid Chromatograph (HPLC) for Improved Instruction in Chemistry"

The quality of scientific training offered to students is being improved with the purchase of a high pressure liquid chromatography instrument for use in five laboratory courses. This is allowing the Department to include as a part of the students' scientific training the principles and practice of HPLC - the most versatile method for separating and quantitating the variety of complex mixtures which chemists encounter. Introduction of the HPLC into the Chemistry Department's laboratory curriculum is enabling students to work with a wider range of mixtures - especially those containing non-volatile solids or thermally sensitive compounds - than was previously possible with the departmental instrumentation. For instance, the students are doing experiments involving the separation and quantitation of proteins in a mixture or determining the lipid composition of a cellular membrane. Including these new experiments in the laboratory program of the Department is significant because it is enhancing the ability of the science students to investigate chemical systems and solve chemical problems.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Louis G. Arnold	USE 8750148
Otterbein College	FY87 $9,525
Westerville, OH	Physics

"Computer Simulation and Computer Data Acquisition in Undergraduate Physics"

Otterbein College will integrate computer modeling and computational methods into the advanced courses of the physics curriculum and on-line data acquisition and analysis into experimental laboratories. Integration of these techniques with the advanced courses require on- site computer equipment for illustrative demonstrations, computational experiments and problem solving, and the acquisition and analysis of data. The equipment necessary to implement this expansion of the physics curriculum consists of 1) a computer physics work station and associated software; and, 2) an experimental physics laboratory work station with interface devices suitable for the diversity of instruments found in an advanced undergraduate laboratory. The acquaintance with current practices of working physicists provided by the equipment requested will give students a first-hand knowledge of all aspects of computer use as a physics research tool.

FACULTY ENHANCEMENT

George K. Miner	USE 8854228
University of Dayton	FY88 $223,013
Dayton, OH	Other NEC

"Chautauqua Short Courses for College Faculty"

This project will provide partial support for a series of short courses on topics of current interest to college and university science faculty. The course presenters are scholars at the frontiers of their disciplines who meet intensively for several days with faculty to communicate new knowledge, concepts, and techniques which will enhance college instruction. The National program will offer about 70 courses per year at locations in the various regions of the country. Also, some courses will be offered at special discipline-related sites. Included will be topics of interest to faculty in mathematics, the natural and social sciences, and engineering. The program will be evaluated for constant improvement of its service to faculty. It will update and enhance the teaching of an average of some two thousand college and university faculty each year.

In addition to NSF support, participants and their institutions will contribute about three times as much to the operation of the project.

TEACHER ENHANCEMENT PROGRAM

Patrick K. Williams	TPE 8751862
Charles J. Ritter	FY88 $114,687
University of Dayton	Life Sciences
Dayton, OH	

"Teacher Enhancement Workshop in Field Biology and Geology for Middle School Teachers"

A six-week field biology and geology workshop will be conducted by University of Dayton scientists for 20 middle school teachers. It will focus on the acquisition and development of skills in problem solving and an additional knowledge base in ecology and geology. Emphasis will be placed on applied biology, field biology, and environmental geology. The target group of teachers are the less well-prepared middle school teachers in southwestern Ohio, including both large urban centers, such as Dayton, Cincinnati and Columbus and suburban areas surrounding the cities and the University.

The first three weeks of the program will include an introduction to the principles of geology and ecology as well as discussion of local resources and their uses. Following that, the group will travel by vans to a field facility outside of Denver, Colorado to investigate the biology and geology of the area around the High Altitude Laboratory on the slopes of Mt. Evans.

Because this project includes both a home-based study and a distant field site, teachers will experience a unique opportunity to participate in an exciting environment, and apply the field techniques to their local environment. Modules for school use will be developed with the assistance of project staff and mentor teams selected from previous participants. Six evening meetings and several field trips are included in the follow-up plans for the academic year.

YOUNG SCHOLARS

Dorothy R. Winkeljohn	RCD 8850107
Wright State University	FY88 $38,777
Dayton, OH	FY89 $38,777
	Archeology

"Project DIGS (Developing Individual Growth in Science)"

Projects DIGS (Developing Individual Growth in Science) is designed to enhance the interest of 30 secondary school students in science disciplines as possible career choices. This project targets 8th, 9th, and 10th grade students from a seven-county area surrounding Wright State University. Interest in science careers is developed through an intensive three-week summer institute, followed by 9 months of academic-year activities. The workshop places students in an experimental research environment, using archaeology as an entry mode for rich interdisciplinary learning.

Students have hands-on experience in the process of scientific inquiry through participation in a simulated archaeological dig and through observation of, and interaction with, practicing local archaeologists and paleontologists currently conducting a dig. Topics in related sciences are introduced as a natural outflow from concepts and phenomena encountered by the students during their research (e.g., earth science and chemistry applications in the archaeological field). Career information is integrated with content knowledge throughout the curriculum. Multimodal teaching/learning activities and strategies are used, with most classroom activities being structured as small group cooperative projects.

TEACHER ENHANCEMENT PROGRAM

David C. Flaspohler	TPE 8751335
Raymond C. Pfriem	FY88 $54,790
Xavier University	Mathematics
Cincinnati, OH	

"Preparing Lead Teachers in Statistics and Probability"

In the environment where the state has mandated that statistics will be taught in the schools of Ohio and has granted monies to Xavier University to educate teachers who have a weak background in statistics, this project has developed a workshop for lead teachers dealing with content and pedagogical questions related to the teaching and learning of probability and statistics. The lead teachers also receive instruction on how to work with other teachers in the state and thereby are able to extend the ideas of the workshop to other teachers in the state. This will enable the ideas of the workshop to reach a much larger teacher audience and to develop a regional network of educators related to the teaching of statistics. The workshop will be geared to 48 lead teachers who will in turn work with the remainder of the 105 teachers in the area where statistics is required.

COLLEGE SCIENCE INSTRUMENTATION

Stephen C. Yerian	USE 8750228
Xavier University	FY87 $10,081
Cincinnati, OH	Physics

"Modernization of an X-Ray Physics Laboratory Program for Undergraduates"

Xavier University will upgrade and update the x-ray physics component of the atomic physics laboratory program taken by physics, applied physics, and physics concentration education majors. By replacing an aging and obsolete x-ray tube power supply with a modern, high-power, highly stabilized and regulated DC high-voltage power supply for the generation of x-rays, significant improvements in x-ray diffraction experiments using cameras and diffractometers will be achieved. By adding a timer and a counter to the data acquisition system and interfacing system to a computer, students will be able to perform experiments using modern digital techniques. The new power supply and new instrumentation will improve the way students perform existing experiments: Bragg diffraction, back-Laue reflection, and diffractometry. In addition it will make possible new experiments, for example the measurement of x-ray line intensities and intensity ratios and the study of line shapes and fine structure, as well as the computerizing of data acquisition in all experiments. Finally, the new instrumentation will provide a reliable x-ray system for student research projects.

COLLEGE SCIENCE INSTRUMENTATION

Jeffrey J. Sich USE 8851165
Youngstown State University FY88 $26,799
Youngstown, OH Biology

"Instruments to Improve the Undergraduate Core Curriculum in Microbiology"

Since 1980, and especially within the last three years, there has been rapid growth in the area of Microbiology in this Department. This is reflected in a 49% increase in the number of students enrolled in the basic microbiology course and the subsequent increase in demand for upper division courses. In response to this demand, a new faculty member, with expertise in immunology, was hired in 1986, providing the Department with the opportunity to expand its offerings in Microbiology and to provide a core of courses approved by the American Society for Microbiology.

The equipment procured through this project is enhancing the laboratory experiences offered, and making it possible to offer additional courses in the near future.

A teaching microscope, compatible with a video display system, provides both an opportunity to improve instruction in microscopy and to use techniques in fluorescence microscopy. The equipping of a tissue culture laboratory permits the experimental manipulation of mammalian cells. Students also are gaining experience in immunoelectrophoresis, ELISA and other microtechniques, and in the manipulation and visualization of nucleic acids.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

OKLAHOMA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Celia J. Hawk
Science
MacArthur High School
Lawton, OK

Judy Hisaw
Mathematics
Roff High School
Roff, OK

1988

Donna J. Hansen
Mathematics
Putnam City North High School
Oklahoma City, OK

Richard J. Bryant
Science
Okmulgee High School
Okmulgee, OK

COLLEGE SCIENCE INSTRUMENTATION

Don Phillips USE 8852254
Cameron University FY88 $50,000
Lawton, OK Mechanical Eng

"Engineering Technology Instrumentation Laboratory Improvement"

This project supports the Engineering Technology program at this institution by enhancing the instrumentation laboratory. Previously existing CAD equipment is linked to compatible pneumatic and hydraulic test equipment so that students experience state-of-the-art industrial instrumentation and feedback control systems. The lab improvement is achieved through the acquisition of Festo Pneumatic and Hydraulic trainer packages; FESTO Programmable Controller; and NIDA Rotating Machinery and Synchro/Servo training packages.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Betty Lou Acord	USE 8852310
Connors State College	FY88 $13,609
Warner, OK	Mathematics

"Upgrading Mathematical Skills Through Computer Assisted Instruction"

The project will establish a computer laboratory for assisting with the instruction of remedial students. Individualized student plans will be designed and monitored through testing and interviews. The project should give a significant contribution to the institution's interest in improving the mathematical background and interest in a client group that includes minorities and females.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Daniel E. Beeker	USE 8852433
Northeastern Oklahoma A&M	FY88 $20,872
Miami, OK	Physics

"Computers in the Undergraduate Physics Laboratory"

This project incorporates computers into the undergraduate Physics and Pre-Engineering Laboratories. Students use the computers for data acquisition as well as for analysis and presentation of the data. Experiments have been modified from those previously available for manual data acquisition to use the computer in the data acquisition process. A concentrated orientation to the software and the use of the computers for experimental work helps students to use the laboratory more effectively.

The grantee provides funds for this project that are an equal match for the NSF award.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Douglas B. Aichele	MDR 8470460
Oklahoma State University	FY85 $127,143
Stillwater, OK	FY86 $153,355
	FY88 $ 56,057
	Mathematics

"Increasing the Participation of Native American Students in Higher Mathematics"

It is a well-known fact that persons of Native American descent are not represented in scientific and technological fields. This project is developing instructional materials in mathematics aimed at Native American students. The materials use information familiar to the traditions of the Native American culture. To date, careful attention has been paid to the K-3 level, with less attention to the later years. The original proposal had not requested funds for field testing and revision of the materials for the later grades. However, the effectiveness of the earlier program makes it appropriate that we permit a thorough completion of the entire program. This award will permit such evaluation and revisions as well as the solicitation of a publisher for national dissemination.

TEACHER PREPARATION PROGRAM

Douglas B. Aichele	TPE 8751181
John M. Jobe	FY87 $138,219
Oklahoma State University	FY89 $100,271
Stillwater, OK	Mathematics

"Teleconference Instruction in Problem Solving (TIPS)"

This project consists of two interrelated parts. Four teleconferences on problem solving in mathematics appropriate for secondary teachers will be produced. These will be coordinated with a set of four problem solving modules. The effect of this technological mode of delivery on the mathematics problem solving ability and awareness of preservice mathematics teachers in Oklahoma will be evaluated. Comparisons will be made among teachers who participate in the teleconferences and use the modules, teachers who use the modules only, and teachers have access to neither the teleconferences nor the modules. Because the preservice teachers in Oklahoma spend one full year as first-year teachers in schools before they are certified, results of the research study can be generalized to novice teachers in other geographic areas.

This project focuses on two very important facets of teacher education. An area of great concern in mathematics education is the teaching of problem solving at every level in the curriculum. The products from this project will be four video cassettes from the teleconferences that can be used for both preservice and inservice instruction on problem solving. These video cassettes will capture on film, techniques for teaching problem solving, as well as making available to a large audience of prospective teachers and practicing teachers, experts' views on this subject. This in itself might have been a sufficient reason for funding in the Teacher Preparation Program. However, in addition, this project will provide information about the use of teleconferencing as a delivery system for preservice and inservice instruction on a complex topic for which there is great need. Because it is impossible to provide quality inservice instruction for all teachers in the country in workshop settings, especially in geographic areas where the population is sparse, the teleconference may be an appropriate manner of updating teachers' backgrounds. This project will provide evidence for the desirability of the use of teleconferences in working with teachers. If it is found to be appropriate, it could reform the mode of delivery of mathematics education inservice instruction throughout the country.

YOUNG SCHOLARS

David A. Francko	RCD 8850281
Earl E. Lafon	FY88 $59,865
John I. Gelder	FY89 $59,865
Margaret Ewing	HS Science
Oklahoma State University	
Stillwater, OK	

"Young Scholars Program: Futures in Science"

The College of Arts and Sciences, Oklahoma State University, conducts a three-week Young Scholars Program designed for thirty-six students, grades 9-12. Those who attend will better understand the ways that scientists think and work, will recognize the many opportunities in science, and will experience the excitement of interacting with scholar-mentors and other outstanding students in an enriched academic environment.

All students attend morning presentations, workshops, and tours. The first week of morning sessions deals with information and research, focusing on statistics and mathematics for the scientist. The second week is devoted to the social implications of scientific study and advancement, specifically ethical issues. The last week of morning sessions covers career options from a variety of perspectives: discussions with counselors and advisors, completing a career evaluation examination, hearing educators and professionals describe their work, and exploring the sites where scientists go about their jobs.

In the afternoons, the students learn to use the laboratory safely and effectively to complete assignments under the close direction of university faculty. In groups of twelve, students work for one week each in the chemistry, life sciences, and physics laboratories. The academic work in the afternoon sessions is rigorous, informative, and productive.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

John I. Gelder	MDR 8751528
Isaac D. Eubanks	FY88 $185,855
Oklahoma State University	FY89 $199,171
Stillwater, OK	Chemistry

"AP Chemistry by Satellite"

Students from small high schools are often educationally disadvantaged when they reach college because their schools lacked the resources required to teach those advanced courses that would have helped them succeed in college. This project will determine whether live instruction-by-satellite is a viable means of providing high school students with an advanced course in chemistry. The opportunity will be offered to schools which are too small or lack resources to provide Advanced Placement Chemistry, but which do offer one year of the subject. The format will be designed to incorporate as many of the desirable features of live classroom instruction as are possible. It will include video- and computer-based learning experiences for students that usually cannot be done in a live classroom. Students will be able to ask questions and respond to their distant instructor during each telecast. They will do experiments in their own school laboratories and will exchange data using computers. Local supervision will be the responsibility of the school's "first-year" chemistry teacher who will interact with the University as a cooperating teacher.

It has recently been shown that one of the strongest correlates with persistence at the college level in the study of mathematics and the sciences is the opportunity for the student to take Advanced Placement or Honors courses in the subjects. By allowing students in rural schools to have this experience, the project addresses two important issues: human resources and equity.

TEACHER PREPARATION PROGRAM

Terence J. Mills	TPE 8652078
Oklahoma State University	FY87 $241,903
Stillwater, OK	FY88 $686,311
	FY90 $107,471
	FY91 $118,643
	MidSch Sci/Math

"The "DIRECT" Middle School Science and Mathematics Project"

This middle school mathematics and science preservice teacher education program builds on existing secondary and elementary teacher education programs. Certification with middle school science or mathematic endorsements will be possible at either the elementary or secondary level.

At the elementary level, 36 semester hours of science or 27 semester hours of mathematics courses will be required. This will be accomplished by redirecting up to 20 semester hours from education courses to science and mathematics content courses. At the secondary level, 20 of the 52 semester hours of science content courses will be specific to the middle school; in addition the program will include two specially designed psychology courses. Other specially designed program elements will include: laboratory sections for existing science courses; three capstone courses in earth, biological, and physical sciences; companion methodology courses coupled with appropriately placed field experiences; a mentor teacher system; and informal learning activities incorporating applied mathematics and science concepts from "the real world" developed for the new programs. A special mathematics modeling course and a mathematics history course will be developed to be used in both mathematics tracks. In all, fifteen new courses will be developed: 3 in science, 2 in mathematics, 2 in psychology , 2 in methods, and 6 for field experiences. The project takes advantage of an existing Entry-Year Assistance Program in Oklahoma to provide support to graduates during their first year and feedback to the university on the effectiveness of the new programs.

The project director, a science educator, is joined by an applied mathematician and an inorganic chemist; these two people will serve as co-directors. The project staff draws heavily from the disciplinary departments of the university and local school systems.

PRIVATE SECTOR PARTNERSHIPS

Marwin K. Kemp
Eric L. Bandurski
Nancy N. McDonald
Tulsa Public Schools
Tulsa, OK

TPE 8751221
FY88 $120,000
Elem Science

"Science Enrichment"

The Tulsa Public Schools will expand a successful pilot program to bring hands-on science experiments into elementary and middle school classrooms. The objective is to expand interest in and appreciation for science by all students, thereby contributing broadly to the enhancement of science literacy. Scientists (one a former college chemistry professor) with Amoco Production Company's Tulsa Technical Center developed appropriate physical and biological science experiments and prepared kits of the necessary materials for them. Volunteers from the Junior League, the American Chemical Society, Amoco, Cities Service Co., and parent groups were trained, jointly with teachers, in the use of these kits, and then each went biweekly into the classrooms to support students working in groups of two to four in carrying out the experiments. The program was tested first in fourth and fifth grade classes, then expanded to middle school, and now will be applied more broadly throughout the system in those grades.

TEACHER ENHANCEMENT PROGRAM

Edmund A. Marek
Suzanne B. Methven
University of Oklahoma
Norman, OK

TPE 8652293
FY87 $90,409
FY88 $96,669
Multidisciplinary

"Development and Evaluation of a Model Inservice Program for Secondary School Science Teachers"

Fifty teachers will participate (25 in the summer, 1987, and 25 in the summer 1988) in a Master Teachers Workshop for 4 weeks. The foci of this workshop are on the process-structure of science and developmental learning theory. Each teacher will complete the study of two of three curricula: biology, physics, or chemistry. Daily seminars on science and learning-theory bases relating to these curricula will be an integral part of the workshop. Three follow-up sessions for the participants will be conducted during the academic year.

Participants will be chosen from school districts in Kansas, Northern Texas, Arkansas, Southern Missouri, Eastern Colorado, and New Mexico. The primary goal of this project is to train a cadre of master teachers who will provide inservice education for teachers in their school district using learning cycle-based curricula.

The participants will be provided with a complete set of curricular materials with permission to reproduce the materials for other teachers within their local school system. Each participant's school system will be required to make significant commitments and provide adequate support systems to enhance the summer participants' local staff development activities.

YOUNG SCHOLARS

Martin A. Abraham
Ramon L. Cerro
Richard E. Thompson
Kerry L. Sublette
Keith D. Wisecarver
University of Tulsa
Tulsa, OK

RCD 8850148
FY88 $30,639
FY89 $30,639
Chemical Eng

"An Introduction to Chemical Engineering for Native American and Minority High School Students"

This project is designed to increase awareness of engineering as a career for 20 Native American, minority, and female students entering the 9th, 10th and 11th grades. Students are selected from the northeastern Oklahoma regional area, which includes portions of northwest Arkansas, southwest Missouri, and southeast Kansas. This is a two-week, on-campus session at the University of Tulsa where the scholars interact with departmental faculty, undergraduate students in Chemical Engineering, and selected representatives from local industry (including individuals from the various groups at which this program is targeted). In addition, the scholars are exposed to hands-on chemical engineering problems through laboratory experiments and a small research project.

TEACHER ENHANCEMENT PROGRAM

Steffen H. Rogers — TPE 8751667
Harrington Wells — FY88 $416,303
Ralph Heller — Biology
University of Tulsa
Tulsa, OK

"Molecular Genetics and Cellular Biology in Primary and Secondary Education"

Over the next three years the University of Tulsa will conduct a series of four-week workshops for regional elementary and secondary biology teachers and their principals in the areas of modern molecular genetics and cellular biology. This project was designed in direct response to the expressed needs and requests of regional teachers, principals, and superintendents who, in every instance, listed a lack of knowledge in modern molecular genetics and cellular biology as their primary deficiency in the teaching and/or understanding of modern biology.

Twenty teachers per year and their principals will participate in this program, which will serve as the basis for an articulated regional biology program. The workshop will be heavily content-based with researchers from universities, research institutes, and private industry acting as presenters on the specific topics with which they are working. Half of each day will be spent in the laboratory dealing with the experiential aspects of the topics covered in the lecture portions. Teachers and master teachers working together will also "translate" the lab activities to the appropriate level for students.

Elementary and secondary teachers and administrators will work together to create an articulated educational model. Presentations by superintendents who have been successful in implementing an articulated curriculum, a concurrent principal's workshop, and a rigorous evaluation of the project will be implemented. Previous experience has demonstrated that a combined elementary/secondary program can be extremely successful in fostering change in a school district.

The University of Tulsa, the Tulsa Educational Foundation, and the participating school districts have contributed 24% as their share of the cost of this project.

OREGON

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Ronald J. Zaraza
Science
Woodrow Wilson High School
Portland, OR

Fred Rectanus
Mathematics
George Middle School
Portland, OR

1988

Bonnie Briggs
Mathematics
Creswell High School
Creswell, OR

Marian R. Gerst
Science
J B Thomas Junior High School
Hillsboro, OR

COLLEGE SCIENCE INSTRUMENTATION

Charles J. Kunert — USE 8750673
Concordia College — FY87 $9,153
Portland, OR — Biology

"Facilitation of Research by Undergraduates in Life Science"

The Life Sciences Department is requiring an independent research project as a component of its curriculum for majors. This Senior-year project is involving students in research with a particular focus upon Molecular Biology. Powerful motivators, the projects provide students an environment for developing modern laboratory skills and techniques while pursuing a currently important biological question. As a result, these undergraduates better comprehend the essence of science while at the same time they gain better preparation for entering careers based on scientific processes. Participants are being encouraged to communicate the results of their research to their peers and to other scientists through publication and/or oral presentation of their work.

The new equipment provided through this grant is being used for basic work in Molecular Biology, including the purification and experimental manipulation of nucleic acids. The simplicity of many of the techniques employed in Molecular Biology makes it feasible for undergraduates to accomplish significant work if properly motivated and supervised.

COLLEGE SCIENCE INSTRUMENTATION

John C. Abele	USE 8851283
Lewis and Clark College	FY88 $26,927
Portland, OR	Physics

"Solid State Laboratory for Advanced Undergraduate Physics Students"

The Physics Department is developing a modern laboratory for teaching Solid State Physics. Building on a base of introductory and intermediate courses, the Physics faculty has recently turned its attention to the development of a series of advanced laboratory/student-faculty research investigations which will serve to emphasize topics being studied in Thermodynamics and Statistical Mechanics, Modern Physics, Solid State Physics and Quantum Mechanics.

Solid State Physics was selected to illustrate fundamental interactions of electrons with matter. The development of this laboratory is also very practical in view of the graduate and career plans of undergraduate Physics majors. The laboratory will support a range of experiments of differing degrees of sophistication. A number of pieces of equipment for crystal growth and electrical and optical measurements have or are being acquired.

The central piece of equipment in this project is a superconducting magnet and variable temperature cryostat to be used to investigate fundamental properties of materials. The system is capable of temperatures from 1.5 to 300 Kelvin and magnetic fields up to ten Tesla. This system will be used by students enrolled in Advanced Laboratory, Undergraduate Research, or student-faculty collaborative research. Examples of concepts to be studied are: magnetic susceptibility, specific heat, electrical conductivity, Landau quantization, electronic band structure, superconductivity, and semiconductor carrier concentration.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

James A. Duncan	USE 8851627
Lewis and Clark College	FY88 $62,700
Portland, OR	Chemistry

"Acquisition of a High-field Fourier Transform Nuclear Magnetic Resonance Spectrometer for Undergraduate Research and Instruction"

A High-Field Fourier Transform Nuclear Magnetic Resonance Spectrometer System including variable temperature, hard disk, and coprocessor accessories is being used to introduce new experiments in the Physical, Inorganic, Advanced Analytical, and Introductory Organic Chemistry Laboratory Courses. The scientific productivity of the undergraduate research program is being substantially increased. Examples of student research projects which are being made possible by this instrument included: (I) studies of the stereochemistry of augmented thermal and photochemical Cope rearrangements; (II) synthesis and studies of the regio- and stereochemistry of dealkoxycarbonylation reactions of thienyl substituted polyalkoxycarbonyl ethenes as possible polythienyl precursors; (III) synthesis and conformational studies of Schiff base coordination compounds as possible laser materials; and (IV) the synthesis of silicone compounds of theoretical interest.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Robert G. Wolcott	USE 8750192
Linfield College	FY87 $26,372
McMinnville, OR	Chemistry

"NMR in Undergraduate Instrumentation in Chemistry and Physics"

The use of a recently acquired 60 MHz nuclear magnetic resonance (NMR) spectrometer with lock/decoupler and variable temperature accessories is modernizing and significantly broadening the training of undergraduate students in chemistry and other sciences at Linfield College. This is being accomplished through the implementation of six instructional objectives: (1) training students in the use of NMR to rapidly generate detailed information about the physical structure of small molecules; (2) helping students verify the identity of organic compounds synthesized in the laboratory; (3) providing a way to measure subtle temperature-dependent physical changes in molecules; (4) illustrating physical principles related to nuclear spin; (5) introducing students to a means of rapidly determining the relative quantities of known compounds in mixtures; (6) encouraging undergraduates to become involved in research projects.

COLLEGE SCIENCE INSTRUMENTATION

John M. Yarbrough	USE 8851227
Omar Zia	FY88 $37,816
Oregon Institute of Technology	Electrical Eng
Klamath Falls, OR	

"Analog Circuit Instruction Improvement"

This project enhances the curriculum of an Electrical Engineering Technology Program by providing a laboratory environment for the study of analog circuits using computer aided engineering techniques.

The laboratory equipment includes Rapid Systems spectrum analyzer/digital storage oscilloscopes connected to personal computers. These systems provide significant spectral analysis digital sampling capability at low cost. Students using the laboratory are able for example, to sample transients, save waveforms and later compare these to new waveforms.

This award is being matched by an equal sum from the grantee.

COURSE AND CURRICULUM

Thomas Dick	USE 8813785
Oregon State University	FY88 $27,401
Corvallis, OR	Mathematics

"Plan for Calculators in the Calculus Curriculum"

Oregon State University (OSU) will work with Hewlett-Packard to develop and implement a calculus curriculum which makes essential use of the HP28S symbolic/graphical calculator.

The objectives are to identify: calculus topics pedagogically suited for use on symbolic/graphical calculators; roles of symbolic/graphical calculators in calculus; production of curriculum/calculator materials to be tested during the academic year.

Charles Patton, a developer of the HP28, who is writing a calculus book based on the HP28 will provide both technical advice regrading the calculator as well as allow adaptation of his calculus text materials, which are appropriate for the pilot classes at OSU.

In addition, the principal investigator and exemplary high school teachers from the Title II HP28 calculator project will present a series of workshops at the Northwest Conference on utilizing the HP-28 in mathematics classes.

Oregon State and Hewlett-Packard will share costs of this project.

FACULTY ENHANCEMENT PROGRAM

Michael W. Schulyer	USE 8854161
Edward H. Piepmeier	FY88 $63,823
James D. Ingle, Jr.	Chemistry
Joseph W. Nibler	
Douglas A. Keszler	
Oregon State University	
Corvallis, OR	

"A Workshop in Interfacing Microcomputers to Chemical Instrumentation in the Undergraduate Laboratory"

This project will introduce faculty in the physical and life sciences who teach at four-year colleges to the use of computers in experimental work. The emphasis will be on learning how computers can be interfaced to instruments and experimental apparatus for the purposes of experimental control and data acquisition. The activity will involve both lecture and laboratory work over a four week period. After an introduction to fundamentals of digital electronics, signal conditioning, personal computer architecture, and programming, participants will produce a digital oscilloscope and interface personal computers to spectrometers and titration apparatus. Topics will include serial and parallel data transfer, analog sampling principles, and integrated circuit timers. After the instructional phase of the course, participants will select among a number of specific applications for further study. Included among these are examples of interfaces to spectrometers, a liquid chromatography application featuring computer-controlled valve manipulation, a Fourier transform infrared spectrometer, an X-ray diffraction spectrometer, and two undergraduate chemistry experiments which use computers to improve the quality of the data being collected. The program is intended for faculty who wish to incorporate computer interfacing into their own teaching of experimental science.

In addition to the NSF funds, participants' institutions will contribute about 5% in travel costs to the operation of the project.

COLLEGE SCIENCE INSTRUMENTATION

Richard V. Whiteley	USE 8851866
Pacific University	FY88 $14,951
Forest Grove, OR	Chemistry

"Integrated High Performance Liquid Chromatograph for Undergraduate Instruction"

A computer-controlled, modern, High Performance Liquid Chromatograph (HPLC) is providing the capability for students to study state-of-the- art methods for separation and analysis of complex liquid solutions. Computer control is being achieved by purchasing appropriate hardware and software in lieu of the dedicated terminal normally supplied with the chromatograph. With this modification, the new chromatograph is being integrated into the existing computer network at the university, which will vastly increase the effectiveness of the instrument. Data acquisition, processing and storage and instrument control is becoming more flexible, and interaction with other instruments on the network (e.g., visible/ ultraviolet spectrometer and gas chromatograph) is becoming feasible. The modernization of the HPLC capability is necessary for the Department to maintain adequate facilities for the education of the small group of Chemistry majors and the considerably larger group of Health Science majors. The instrument is being used throughout the Chemistry curriculum as well as throughout the Natural Science Division for undergraduate student research.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

David C. Cox	TPE 8751850
Paul E. Hammond	FY88 $338,584
Stephen M. Carlson	Geology
Portland State University	
Portland, OR	

"A Model for Studying Natural Phenomena Using Mt. St. Helens"

Thirty outstanding secondary school science teachers, fifteen from middle schools and fifteen from high schools, will be selected from around the nation to participate in a two-week summer workshop. These teachers, who have demonstrated potential leadership abilities in science education, will study evolution, behavior, and unique hazards associated with the Cascade Range volcanoes in general, and Mt. St. Helens in particular. The comprehensive two-week program will include formal classroom activities, discussions, computer simulations, video, and field work.

Participants will develop instructional materials during and after the workshop suitable for use in their local settings. School districts will support their teachers by contributing money for materials and providing released time for the presentation of workshops to fellow teachers and members of the local community. A long-term, comprehensive follow-up and evaluation program will feature involvement of participants, administrators, members of the academic community in participants' locales, and project staff.

This project brings together many elements of the science education community, namely, a set of experienced teachers, university faculty, federal agency and private sector instructors, school district administrators, and an exciting environment as the setting for the project.

TEACHER PREPARATION PROGRAM

Leonard T. Nelson	TPE 8652054
Portland State University	FY87 $198,773
Portland, OR	FY88 $486,688
	FY90 $217,914
	FY91 $116,847
	Mathematics

"A Program for Preparing Middle School Mathematics Teachers"

This project will develop a comprehensive program for preparing middle school mathematics teachers in an urban setting. Instructional materials for nine courses (8 content and 1 method) specifically designed for a middle school mathematics program will be developed. These will be presented in an instructional mode that stresses active exploration, concept development, visual reasoning, and the integrated use of calculators and computers as the dominant computational tools. The materials to be developed for each course include a course guide with topical commentary, student assignments, reading lists, a bibliography and description of class activities. The activities will be used in field experiences and in student teaching. The materials will be produced with the desktop publishing facilities of Portland State's Math Learning Center and will be suitable for widespread distribution or commercial publication. The materials will be evaluated carefully during development and implementation.

The project staff includes mathematics educators, research mathematicians, and classroom teachers.

COLLEGE SCIENCE INSTRUMENTATION

John E. Hancock	USE 8750840
Reed College	FY87 $30,531
Portland, OR	Chemistry

"Acquisition of a FT-IR Instrument, and its Integration into Reed College's Chemistry Curriculum"

A Fourier Transform Infrared Spectrometer is being used in a number of courses by the Chemistry Department at Reed College to afford students a wider opportunity to utilize modern, state-of-the-art instrumentation in their undergraduate studies. Applications in both introductory and advanced organic, inorganic, physical, and instrumental chemistry together with a significant focus on undergraduate research are involved.

COLLEGE SCIENCE INSTRUMENTATION

John E. Hancock	USE 8852500
Ronald W. McClard	FY88 $100,000
Reed College	Chemistry
Portland, OR	

"Acquisition of a High Field NMR Spectrometer, and its Integration into the Chemistry Curriculum"

The Chemistry curriculum is being upgraded with the acquisition of a Bruker AC-E 250 MHz NMR spectrometer with a special probe unit allowing detection of resonances from proton, carbon-13, fluorine-19 and phosphorus-31 nuclei under (switchable) computer control. The analytical capability is being extended with the ability to analyze all four nuclei and the data is being processed via a computer. The present laboratory curriculum is being extended with the introduction of new NMR experiments in six courses and with the ability to do 2D analysis of spectral data and appropriate double resonance and pulse techniques in senior thesis research.

Students are running spectra on a user-friendly instrument in introductory organic and inorganic. Introductory organic is being converted to microscale syntheses and analyses with the increased sensitivity of the instrument. Senior thesis research is being facilitated with the new capability.

The grantee is more than matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Maryanne McClellan USE 8852739
Peter J. Russell FY88 $93,560
Reed College Biology
Portland, OR

"A Core Facility for Teaching Undergraduate Cellular and Molecular Biology"

The recent impacts of Molecular and Cellular Biology on the theoretical framework of every biological subdiscipline are causing large numbers of undergraduates in this department to enroll in Cellular and Molecular Biology courses. Sophisticated aspects of molecular and cellular theory presented in lecture require students to reference the current literature frequently, and to engage in appropriate laboratory exercises. These pressures made previously available instructional instrumentation grossly inadequate, forcing the use of obsolete experimental designs.

This project is alleviating these difficulties by providing two refrigerated centrifuges, an ultracentrifuge and rotors, an inverted fluorescence photomicroscope, eight horizontal electrophoresis stations, a DNA sequencing system, apparatus for the separation of chromosome-sized DNA fragments, deep freeze, incubator/shaker, five UV/VIS recording spectrophotometers, vacuum oven, photographic recording system for agarose gels, and a water purification system. The result is to provide sufficient numbers of modern centrifuges and spectrophotometers to execute smoothly laboratory experiments on subcellular fractionation, enzyme reaction kinetics, and molecular cloning; to permit curricular change in the form of advanced laboratory exercises such as macromolecular localization and DNA sequencing; and to make available state-of-the-art instrumentation for student research projects in all fields of biology.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

J. W. Powell USE 8851509
Reed College FY88 $93,831
Portland, OR Physics

"An FTIR Spectroscopy Laboratory for Teaching and Undergraduate Research"

This project will establish a Spectroscopy Laboratory so that undergraduate physics majors can employ the powerful techniques of Fourier transform infrared spectroscopy in laboratories at the senior, junior, and sophomore levels. The flexible, research level Bruker 1FS 113V spectrometer will provide the equipment necessary for senior Physics majors to complete their required thesis in at least two fields of solid state spectroscopy: transmission measurements on nucleic acids and reflection measurements on high temperature superconductors. The instrument will also be used for experiments in the Advanced Laboratory and for demonstrations and limited hands-on experience in the sophomore laboratory. The instrument will provide excellent preparation of Physics majors for graduate work in Experimental Physics. In particular, the spectrometer will provide students with the opportunity to undertake advanced experiments and research projects, leading to talks at professional meetings. On a broader scale, this project will establish a serious undergraduate Experimental Physics program on the campus.

The grantee is matching the award from non-Federal sources.

PRIVATE SECTOR PARTNERSHIPS

K.Gail Nashner-Whitney TPE 8851030
Tamra Busch-Johnsen FY88 $ 55,945
Saturday Academy FY89 $142,941
Beaverton, OR Other NEC

"Effective Models for Business/School Partnerships"

The Saturday Academy, an adjunct of the Oregon Graduate Center, which offers extra-school courses for motivated pre-college science students, will join with the Business/Education Compact of Washington County (WA) in three programs:

(1) Community-based science and technology teacher enhancement programs. As with previously successful student courses, they will be taught by a variety of professionals at sites throughout the area, ranging from industries to academic institutions. Classes will be informal and participative, stress currently important areas of science and technology, and provide material for teachers to incorporate into their own teaching.

(2) An invention-oriented creativity and design competition for middle school students. Teachers will be trained in techniques of encouraging creativity through the process of invention.

Businesses will be recruited to sponsor the event and provide technical personnel to work with students in developing inventions. The inventions will be displayed and judged at the Oregon Museum of Science and Industry.

(3) Computer networking to link science teachers in other parts of the state to the Saturday Academy and to each other. This will be initiated at four existing satellites of the Academy using existing computer facilities to define how such networking can best be utilized and provide a model for future expansion.

Cost sharing by the partners will total 108% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Darlene H. Southworth USE 8750176
Southern Oregon State College FY87 $28,354
Ashland, OR Biology

"A Scanning Electron Microscope for Undergraduate Biological Instruction and Independent Research"

Using the scanning electron microscope (SEM), a critical point dryer and a sputter coater, the College is bringing to its Biology curriculum a new upper-division course on the Principles and Methods of Scanning Electron Microscopy. Students enrolling in this course gain enhanced understanding of the methods of scientific investigation, greater ability to interpret biological structure, and improved technical skills. An important additional benefit of the facility is the increased opportunity for student research it affords. A substantial fraction of the Department's graduating group of 15 majors annually will have done independent work in ultrastructure. Pre-service Biology teachers, plus upperclassmen from chemistry, geology and physics, also will have access to the SEM and ancillary specimen preparation equipment. Topics include election optics (theory, lenses, resolution), SEM design and operation, specimen preparative techniques (fixation, dehydration, coating), interpretation of images (measurement and shrinkage), surface labelling, elemental analysis, SEM applications to a wide range of organisms and questions, and laboratory safety.

The SEM capability is having a valuable secondary impact on the Department's work in Developmental Biology, Plant Anatomy, Systematic Botany and Entomology, among others. Since SEM preparation does not require time-consuming thin sectioning, it is superior to transmission electromicroscopy in this wide variety of undergraduate applications.

NETWORKS PROGRAM

David G. Moursund TPE 8550588
University of Oregon FY85 $101,081
Eugene, OR FY86 $108,185
FY87 $113,966
FY88 $ 20,968
Computer Science

"Leadership Development for Computer-Integrated Instruction in Pre-College Education"

The primary goal of this project is to develop, test, and disseminate a method for helping teachers and school districts integrate computers as an everyday tool throughout the school curriculum. A secondary goal is to examine the issue of "lower order" versus "higher order" skills in an environment in which computers are readily available as an aid to problem solving. This project is designed to increase the appropriate use of Computer Integrated Instruction (CII) through a Resource Sharing Network.

The Leadership Development Model is made up of the following components: 1) an initial two-day workshop; 2) group meetings every two weeks; 3) individual staff and in-school support system; and 4) a final two-day workshop. This approach includes the development and use of a Leadership Resource notebook to support two kinds of CII leaders. The first group consists of computer coordinators and school administrators. This Notebook will increase their abilities to facilitate changes in teachers and curriculum required by CII. Secondly, the Notebook will help CII teacher leaders make effective use of CI applications as they work with other teachers in their schools and districts. This Leadership Model and Resource Notebook will be field tested and evaluated with teachers, coordinators, and administrators from a variety of school districts in Oregon.

During the final phase of the project, three-day leadership workshops will be held for key teacher leaders, computer coordinators, and administrators from school districts in the Pacific Northwest. Project materials will also be disseminated through national computer and teacher organizations throughout the United States.

The FY88 supplemental award will significantly enhance the dissemination of the materials developed for the Leadership Development for Computer-Managed Instruction Project. Specifically the grant will support:

1. Five training of trainers workshops, each of two to four days in length, at five select sites throughout the United States.

2. The development of a short monograph, specifically designed for people who conduct staff development inservice in computer education, to be used by people participating in trainers' workshops. It is expected that this monograph will be published by the International Council for Computers in Education.

COLLEGE SCIENCE INSTRUMENTATION

Ming-Shu Hsu — USE 8750487
University of Portland — FY87 $50,000
Portland, OR — Mechanical Eng

"An Undergraduate, Interdisciplinary, Computer-Integrated Manufacturing Laboratory"

An interdisciplinary, undergraduate, computer-integrated manufacturing (CIM) laboratory will be set up. The laboratory will include an Intelledex six-axis robotic arm with an integrated vision system and a Brodhead-Garrett computer numerical control lathe and mill. The equipment will be interfaced to an IBM PC/AT and a Data General MV10000 mainframe for CIM experiments and system development. The laboratory will support an optional minor in computer integrated manufacturing for mechanical and electrical engineers in this growing area of need and interest.

COLLEGE SCIENCE INSTRUMENTATION

Michael C. Mulder — USE 8750355
University of Portland — FY87 $50,000
Portland, OR — Electrical Eng

"An Undergraduate Systems Software Engineering Laboratory"

The project will establish a network of workstations to support instruction in system software, software engineering and operating systems courses. A feature of the laboratory will be the creation of animated simulations of computer operations such as the instruction cycle, interrupt processing, time sharing and message passing. The animated simulations will bring motion to the static, abstract drawings presently put on the blackboard and on transparencies. The simulations will allow student interactions. The students will be able to view the dynamics of computer operation at various levels, interrupt the process, or make changes in the external conditions and see the changes in computer operations.

INFORMAL SCIENCE EDUCATION

Lucy E. Lynch — MDR 8652299
Willamette Science & Tech Ctr — FY87 $67,712
Eugene, OR — FY88 $ 6,000
Museums

"Kaleidoscopes: Reflections of Science and Art"

The Willamette Science and Technology Center, a science museum located in the university town of Eugene, Oregon, proposes to design, construct and circulate a 1,000 square foot traveling mathematics and science exhibition, "kaleidoscopes: Reflections of Science and Art" to 15 science museums over a three year period, reaching more than one million visitors. The exhibition will capitalize on popular interest in the 19th century optical toy to provide engaging and stimulating examples of mathematics and physics principles revealed in the exquisite symmetries and surprising patterns of kaleidoscopic reflection.

Interactive exhibit modules will be combined with historic examples and the work of contemporary artists to appeal to a broad range of ages and interests of visitors. Consultants with extensive experience with mathematics and mathematics education will assist in the design of the exhibit units and in the preparation of educational materials that will accompany the exhibition.

The Smithsonian Institution Travelling Exhibition Service (SITES), will manage the circulation and maintenance of the exhibition during its travels and will publish the related educational materials and make them available to host museums.

The FY88 supplement will support increased costs of fabrication for 21 kaleidoscope units that are central portions of the travelling exhibit.

PENNSYLVANIA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

John Hnatow, Jr.
Science
Emmaus High School
Emmaus, PA

Joanne E. Meldon
Mathematics
Taylor Allderdice High School
Pittsburgh, PA

1988

James Saunders
Mathematics
Upper Saint Clair High School
Upper Saint Clair, PA

Elizabeth B. Chesick
Science
The Baldwin School
Bryn Mawr, PA

COLLEGE SCIENCE INSTRUMENTATION

Gerald L. Kreider USE 8750872
Albright College FY87 $8,462
Reading, PA Biology

"A High Speed Centrifuge to Complete the Development of an Undergraduate Course in Molecular Genetics"

A course in Molecular Genetics is being developed with a laboratory that emphasizes gene cloning techniques. This project is providing a high speed refrigerated centrifuge for use in large-scale preparative procedures (plasmids, competent cells, DNA fragments). Other equipment needed for this laboratory already has been acquired and currently is being used by undergraduates to test suggested protocols for actual class experiments in Molecular Genetics -- experiments that are designed to enable the undergraduates to understand and apply modern methods for analyzing genetic systems at the molecular level.

The unique value of this project for small, undergraduate Biology programs is that it uses readily available equipment, microbial strains, reagents and procedures; provides exposure to nucleotide sequencing and Southern blotting techniques without use of radioactive isotopes; and is one that can be implemented safely in any physical facility which conforms to the standard safety features found in most college Microbiology laboratories. Available microcomputer software, some in the public domain, is incorporated in laboratory applications used for sizing restriction fragments of DNA and for nucleotide sequence analysis.

COLLEGE SCIENCE INSTRUMENTATION

Samuel S. Harrison USE 8851340
Allegheny College FY88 $11,900
Meadville, PA Environmental

"Water Analysis Laboratory for Undergraduate Instruction"

The Water Analysis Laboratory is used by undergraduates for coursework in Water Analysis, required of Environmental Science majors. The central piece of equipment in this laboratory is an atomic absorption spectrophotometer. Use of this instrument is essential for students learning the application of basic Chemistry to the study of environmental problems. Many of the student senior research projects in Environmental Science, as well as in Biology and Geology, rely on atomic absorption spectrophotometry as the primary means of collecting data by conducting chemical analyses of water, rock, soil, plant and animal samples.

The grantee provides funds for this project that are an equal match for the NSF award.

FACULTY ENHANCEMENT

Maurice F. Aburdene USE 8854268
Edward J. Mastascusa FY88 $44,953
William J. Snyder Electrical Eng
Bucknell University
Lewisburg, PA

"Workshops on Integrated Engineering Workstations for Science and Engineering Faculty"

An important aspect of the current crisis in engineering education is the need to improve the state of undergraduate engineering and science laboratories. Recent advances in computer and instrumentation technology have increased computational power and versatility while dramatically reducing cost. Thus the individual scientist and engineer now has the potential for conducting experiments with a precision and sophistication not achievable previously. Industries are already using automated computer-assisted measurement and control systems to increase productivity and universities are starting to realize the value of workstations. However, educated faculty are needed to transmit the capabilities of the workstation to students. Bucknell began the implementation of engineering workstations across the undergraduate curricula three years ago, and currently it is using them in most of its engineering laboratories.

Bucknell will conduct two five-day workshops for a total of 40 engineering and science faculty on the use of integrated engineering workstations in undergraduate laboratories. The participants will develop an experiment and class material for implementation at their institution. Bucknell faculty will sustain the development of the experiments by providing continued interaction through BITNET.

Participants will be educated in current laboratory technologies by interacting with workstations to perform science and engineering experiments. The project will emphasize the philosophy and techniques required to develop modern computer-controlled experiments for students developing a creative problem-solving ability.

COLLEGE SCIENCE INSTRUMENTATION

Mitchell I. Chernin	USE 8750783
Bucknell University	FY87 $43,462
Lewisburg, PA	Multidisciplinary

"A Laboratory Course at the Interface of Chemistry and Biology"

A research course is being taught jointly by members of the Biology and Chemistry Departments, that introduces students to the theoretical implications and practical applications of various techniques at the interface of chemistry, biochemistry and molecular biology. This is particularly important in light of the current and continued emphasis on biotechnology. A work station approach, utilizing spectrophotometric, chromatographic and electrophoretic equipment in an inter-related fashion is the primary focus of the course. Students are being required to isolate, purify and characterize specific proteins and nucleic acids using the equipment. The students are being exposed to a variety of scientific perspectives and techniques as they are actually being carried out in laboratories. The students are being given the opportunity and the training necessary to apply these techniques to the problems encountered in their own research endeavors.

COLLEGE SCIENCE INSTRUMENTATION

Mohamed A. El-Sharkawy	USE 8851208
Bucknell University	FY88 $12,659
Lewisburg, PA	Electrical Eng

"Real Time Signal Processing Laboratory"

This project develops a signal processing laboratory equipped with the necessary hardware and software to analyze speech and music signals and conduct other signal processing experiments. Using the PC based Tektronix TMS320, Signal Processing Microcomputer, students design digital filters, compare the performance of different design methods, and implement digital filter designs in machine language code. The students also program the TMS320 for other digital signal processing applications, such as Fast Fourier Transforms, real time spectral analysis and speech and music analysis and synthesis.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Jeffrey C. Evans	USE 8750157
Bucknell University	FY87 $26,807
Lewisburg, PA	Civil Eng

"Modernization of the Undergraduate Geotechnical Engineering Laboratory"

Under this project, Bucknell University will modernize its geotechnical laboratory within the civil engineering department. Equipment will be obtained to measure the shear strength of soil and rock in triaxial shear.

Triaxial control panels and triaxial cells will allow the students to measure and control the externally applied total stresses, the pore water pressure, specimen volume change and the stress path. Consolidometers will be used to measure the consolidation properties including preconsolidation pressures and the time rate of consolidation of soils. This laboratory modernization will permit students to conduct laboratory tests on a wide range of soil types with up-to-date equipment.

COLLEGE SCIENCE INSTRUMENTATION

Daniel C. Hyde	USE 8853185
Bucknell University	FY88 $63,354
Lewisburg, PA	Computer Science

"A Parallel Computation Laboratory"

This project permits students to study issues of parallel computation and parallel processing in a flexible, reconfigurable laboratory.

As parallel processing becomes increasingly important in computing, students of Computer Science need to be exposed to facilities that will allow them to explore, in depth, the concepts and limitations of different parallel computational models. The parallel computation laboratory that supports this project is equipped with six (6) parallel processing machines. Each machines contains eight (8) processors which may be connected in a variety of ways including a ring, a pipeline, shuffle-exchange and hypercube. The six parallel machines are connected to one network server allowing the 48 processors to be integrated as one large "supercomputer". Student access to the parallel equipment configuration is via six high efficiency workstations suitable for parallel-program development and debugging.

By being exposed to different parallel computer configurations, students in this project are prepared for an area of computing that is becoming increasingly important both as a practical and research topic.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Patricia A. Wenner	USE 8853222
Bucknell University	FY88 $55,000
Lewisburg, PA	Computer Science

"Computer Graphics Animation"

This project permits undergraduate students to develop graphic software (with film recording) that animates certain graphic algorithms. The laboratory that supports this project is equipped with Sun workstations and a film recorder. Students develop and record graphic algorithms for Computer Science and other disciplines. Experimentation in this laboratory not only allows students to gain insight into the area of visualization techniques but they also produce materials that are used for graphical display of phenomena in other departments.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

James N. Zaiser	USE 8750917
William J. Snyder	FY87 $23,630
Bucknell University	Mechanical Eng
Lewisburg, PA	

"Velocity Measuring Equipment for the Undergraduate Thermo-Fluids Laboratory"

A laser doppler velocimeter will be installed in the thermo-fluids laboratory. This will enable the students to make non-invasive measurements of fluid flow in generalized test sections. Students from the fields of mechanical, electrical, civil and chemical engineering will be able to perform open ended experiments of varying degrees of complexity. Typical experiments planned are measurement of boundary layer velocity profiles in drag reduction, measurement of fluid velocities in radial and sonic flow, and measurement of velocities in a pump turbine test stand.

COLLEGE SCIENCE INSTRUMENTATION

Foster E. Billheimer	USE 8851166
California Univ of Pennsylvania	FY88 $41,444
California, PA	Biology

"A Scanning Electron Microscope to Improve the Undergraduate Biology Curriculum"

The aim of this project is to improve the undergraduate curriculum of the Biological and Environmental Sciences Department through the acquisition of a Scanning Electron Microscope (SEM). The SEM makes it possible to obtain valuable information about the external and internal surface features of specimens and to provide students with increased understanding of structure-function relationships at the cellular level. Since there is such a rapidly expanding body of knowledge in the areas of cell biology and physiology, the Department faced a growing need to update undergraduate courses to provide a sound understanding of physiological processes at the cellular and subcellular levels.

The SEM is being used in the following courses: Techniques of Electron Microscopy, Cell Ultrastructure, Cell Biology, Human Physiology, Microbiology, and Biological Research Investigations. The instrument has been attached to a VCR and TV monitor which extends its instructional capabilities and makes it a uniquely flexible teaching tool. Biological specimens can be examined and videotaped, bringing the actual "search and discover" process beyond the lab into the classroom. Ancillary equipment for the preparation of specimens (a sputter coater and a critical point dryer) are included in the project.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Charlotte A. Zalewsky	USE 8851936
Carlow College	FY88 $8,101
Pittsburgh, PA	Biology

"Equipment for Improving Undergraduate Instruction in Physiology"

The goal of this project is to upgrade the Physiology Laboratories of two courses: Anatomy and Physiology, and Vertebrate Physiology. First, the acquisition of a dual channel recorder accessory transducers and preamplifiers for the existing Thornton physiographs, and the updating of existing physiographs with solid state electronics are resulting in the introduction of two new labs: a Cardiovascular Fitness lab and a Biofeedback lab; the reduction of lab group size, thus providing students with better opportunity for hands-on-experience: and the replacement of demonstration experiments allowing small groups of students to measure such functions as lung volume, EEG's, EKG's and volume pulse measurements in four different laboratories.

Secondly, a TRIAC centrifuge which spins microhematocrits, urine and blood tubes allows students to determine hematocrit for the first time and to perform urinalysis procedures in the Kidney Physiology lab. Thirdly, a T.V. videosystem introduced into eight labs having a Histology component is improving teaching and student use of labs dedicated to the teaching of microstructure. Lastly, a new still provides needed distilled water for physiological solutions.

The above developments encourage experimentation, foster students' understanding of physiological principles, challenge students to think analytically, and encourage technical competence of women, including large numbers of older minority women who are enrolled in the college's "Hill College" program for disadvantaged students. The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

APPLICATIONS OF ADVANCED TECHNOLOGY

John R. Anderson	MDR 8470337
Carnegie-Mellon University	FY85 $342,850
Pittsburgh, PA	FY86 $348,379
	FY87 $302,799
	Mathematics

"The Development of Intelligent Computer-Based Tutors for High School Mathematics"

A new technology will be developed for creating intelligent computerized tutors for high school mathematics based on the principles of the theory of skill acquisition, ACT. This is based on previous research that intelligent tutors are more pedagogically effective than the standard instructional environment but somewhat less effective than trained human tutors. These tutors are successful because they provide the student with a framework in which to solve problems that more accurately reflect the structure of the problem-solving. Furthermore, these tutors tailor instruction to individual students, providing immediate feedback that is maximally effective because it can be encoded within the current problem solving context, and can provide an organization for the problem-solving that circumvents working memory problems by keeping partial results available. The tutors guide the student's problem solving by comparing student responses with solutions constructed by the tutor's "ideal student model."

The principles developed in the LISP and geometry work are general principles of learning and instruction that can be applied to all formal problem-solving domains and can be extended to develop a general tutoring system. This system can be used to construct a tutor for a given domain by providing it with an ideal model, a set of problems, common bugs, and appropriate natural language instruction. Then, the general system would use its domain-independent tutoring knowledge to provide explanation, lesson planning, human engineering, language processing, and problem selection. The general system will be tested by using it to construct tutors for algebra, geometry, and calculus, and comparing students' learning with these tutors to students' performance in standard instructional environments.

APPLICATIONS OF ADVANCED TECHNOLOGIES

John R. Anderson	MDR 8751890
Carnegie-Mellon University	FY88 $401,567
Pittsburgh, PA	FY89 $416,291
	FY90 $500,000
	FY91 $500,000
	Mathematics

"Intelligent Tutors in Algebra and Geometry"

Currently we have developed a technology for effectively producing intelligent tutors that produce about a one standard deviation improvement on high school mathematics achievement. The goal of this research is to develop and demonstrate intelligent tutoring techniques that will yield a dramatic increase in the effectiveness of intelligent tutoring to a three standard deviation effect. This effort will advance in four fronts. We will develop deeper cognitive models that get at the planning behind mathematics problem solving. We will extend our model-tracing techniques to deal with a word-problem-oriented curriculum. We will identify which features of human and computer pedagogical strategy are effective. We will identify develop interface features for delivering speech, for instructing declarative structures, and for graphically reifying abstract mathematical concepts.

The first two years of this proposal will be devoted to exploring these directions. Effort in the third and fourth years will also be directed towards demonstration and dissemination of this technology. We will develop an integrated algebra and geometry tutor that will cover in one year the material that is normally covered in two. We will create a general tutoring architecture that can be used by others to develop mathematics curricula.

RESEARCH IN TEACHING AND LEARNING

David Klahr	MDR 8554464
Department of Psychology	FY 86 $196,359
Carnegie-Mellon University	FY 88 $106,183
Pittsburgh, PA	Computer Science

"LOGO Debugging Skills: Analysis, Instruction and Assessment"

This research addresses the question of how an important computer programming skill -- debugging -- is acquired by elementary and middle-school children, and what the cognitive consequences are of acquiring that skill. One preliminary goal of the proposed research is the development of a well-specified and empirically-supported account of what a child has to know in order to debug a computer program. The proposed work extends preliminary studies of the debugging skills acquired during the course of a normal LOGO curriculum, and it provides for further assessment and elaboration of a computer simulation model of the precise components of debugging skill.

The work will have several interacting components: (1) Empirical evaluation of the model based on a study of experienced programmers' debugging processes; (2) Further development of precise assessment procedures for determining what component skills a student has acquired; (3) Extending the model to a wider range of programming contexts; (4) Using the model to guide specific instructional procedures in teaching debugging skills; (5) Extending and applying a complete one-semester LOGO curriculum with an emphasis on instruction in an assessment of debugging skills; (6) Determining the extent to which debugging skills, once taught, can transfer to near and far tasks; (7) Construction of a model-based prototype debugging aid on a powerful graphics workstation.

APPLICATIONS OF ADVANCED TECHNOLOGY

Philip L. Miller	MDR 8652015
Dennis R. Goldenson	FY87 $348,189
Carnegie-Mellon University	FY88 $274,537
Pittsburgh, PA	FY89 $400,920
	FY90 $100,000
	Computer Science

"The Development and Assessment of a State-of-the-Art Integrated Programming Environment for Computer Science Instruction"

How to effectively teach computer programming is a national problem facing many schools today. Considerable progress has been made in recent years in developing integrated programming environments that combine under a single, uniform user interface the functionality of traditionally separate tools for the editing, translation, testing, and execution of high level code. Both the integrated nature of such environments and their "knowledge" of high level language rules relieve students from needless attention to what fundamentally are extraneous details. Hence the students are freed to concentrate on the essentials of problem decomposition and program structure, and better understand the fundamentals of programming.

Previous work has produced the necessary mechanisms for several key features of a state-of-the-art editing environment. The current aim of this project is to develop a powerful, integrated system that will significantly improve the quality of computer science instruction and make it widely available at minimal cost. The system will include the innovative use of flexible program visualizations to aid the programmer in mapping visual representation to code. It will include an Intelligent Computer Assisted Instruction (ICAI) system capable of individualized tutoring on high level aspects of procedural and data abstraction. An integral part of this project will be the systematic evaluation of the system in a variety of middle school and high school settings.

COLLEGE SCIENCE INSTRUMENTATION

Arthur R. Ayers	USE 8852085
Cedar Crest College	FY88 $11,330
Allentown, PA	Biology

"Undergraduate Research Groups -- A Model Method for Teaching Genetic Engineering Technology"

This project provides equipment needed to create a complete research environment as a training model within the Genetic Engineering Technology Program. This strong new program is designed to provide the conceptual and technical background needed for women to become leaders in professional fields based on modern biological research. The research environment permits training in the use of recombinant DNA techniques, DNA sequencing, and monoclonal antibodies, while teaching central concepts of Molecular Biology. Student research projects extend the use of relevant techniques to areas of active research, while developing self-confidence and independent thinking in women majoring in Biology.

The equipment (fluorescence microscope, chromatography cabinet, ultralow freezer, data acquisition computer and benchtop centrifuge) extends a successful curriculum and is housed in a new facility. With it, undergraduates can conduct research in the area of immunodiagnostics that is of potentially publishable quality, lending greatly increased credibility to the training.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Grace A. Banks	USE 8852679
Chestnut Hill College	FY88 $10,787
Philadelphia, PA	Chemistry

"Introduction of Fourier Transform Infrared (FTIR) Spectroscopy into the Undergraduate Chemistry Curriculum"

The project is allowing the introduction of the important analytical technique of Fourier Transform Spectroscopy into the undergraduate Chemistry curriculum. Laboratory experiences in organic, physical, inorganic, biochemical, and analytical chemistry is being significantly enhanced by the acquisition of an FTIR spectrometer. The improvements in spectral quality and speed of acquisition of spectra is allowing upgrading of the laboratory exercises in IR spectroscopy and is permitting the introduction of new experiments into the curriculum. Experiments with data handling techniques possible on a computer- controlled FTIR instrument is providing students with relevant skills to take with them to graduate school or to industry.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Helen M. Burke	USE 8750633
Chestnut Hill College	FY87 $8,784
Philadelphia, PA	Chemistry

"Quality Laboratory Instruction for the Undergraduate Chemistry/Biochemistry Major in Analytical Techniques and Research Capabilities"

The recent acquisition of an Atomic Absorption (AA) Spectrometer by the Chemistry Department at Chestnut Hill College is significantly broadening the laboratory experience and improving the instruction of undergraduate students majoring in chemistry and biochemistry. The experience of working with an AA Spectrometer is of increasing importance to chemistry and biochemistry majors, whether they seek employment in analytical laboratories or plan to pursue further research in graduate school or industry. The introduction of this technique into advanced organic, biochemical, and instrumental courses ensures that the college's graduates receive the training necessary for careers as chemists and biochemists.

COURSE AND CURRICULUM

Alain Schremmer	USE 8814000
Jose Mason	FY88 $40,124
Community College of Philadelphia	Mathematics
Philadelphia, PA	

"Integrated Calculus Development"

This planning project at the Community College of Philadelphia will develop a Lagrangian calculus for their students, who are predominantly women, minorities and returning adults.

Lagrangian calculus develops concepts via polynomial approximations rather than limits. It reduces questions about "any" function to the same question about a power function, which appears in the approximating polynomial.

This two semester course will be equivalent to pre-calculus and one semester of calculus. The first semester will consist of linear approximations, quadratic, and power functions. The second semester will consist of the differential study of polynomials, Laurent polynomials, rational and elementary transcendental functions by Lagrange's approach.

Experimental sections of the course will also be taught at Essex and Middlesex Community Colleges.

The College is providing over a third of the project's cost.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

COURSE AND CURRICULUM

Eli Fromm	USE 8854555
Robert G. Quinn	FY88 $586,463
Drexel University	FY89 $616,310
Philadelphia, PA	FY90 $455,105
	FY91 $287,207
	FY92 $149,150
	Engineering

"An Enhanced Educational Experience for Engineering Students"

The objective of this project is to restructure the first half of the engineering curriculum in terms of objectives, content, and instructional methodology. The content is organized in three new interwoven areas: Fundamentals of Engineering (FE); Mathematical and Scientific Foundations of Engineering (MSFE); and Engineering Laboratory (EL). FE changes, unifies, integrates and presents in a different way the material now contained in several courses in several departments. MSFE changes, unifies, integrates and presents in a different way the material now contained in several courses in mathematics, chemistry, physics and biology. EL provides significant new experiences in laboratory theory and practice. Central to the changes is that the three areas are coupled and synchronized to complement one another. This manner of organizing the content is expected to be more effective for student learning and more efficient in the use of student time. This should allow more material to be included in this part of the curriculum and help the student to understand better the interrelationships between the various topics. Methods for presentation are heavily oriented toward interactive computer use and the use of electronic media. Both content and methodology focus on the fundamentals of engineering as the unifying theme, the intimate relations with science and mathematics, and the reliance on experimental methods. The co-op program introduces a new area called Professional and Personal Enrichment (PPE). This area focuses on developing a culture for life-long learning by providing a variety of self-directed enriching educational experiences. Matching funds committed by the institution exceed NSF funds for this project.

This project is co-funded with the NSF Directorate for Engineering.

INFORMAL SCIENCE EDUCATION

William H. Booth	MDR 8751446
Franklin Institute Science Museum	FY87 $145,000
Philadelphia, PA	Museums

"The Science of Music: Sound Waves and Sound Forms"

The Franklin Institute Science Museum will design, test, fabricate, and circulate to eight museums an exhibit, "The Science of Music: Sound Waves and Sound Forms" that will introduce visitors to the physical laws that govern sound waves. By using music as an attractive and concrete subject to engage broad public interest, the exhibit will illustrate such topics as sound wave amplitude, phase, frequency, reflection and interference.

Primary support for the project comes from the eight-member Science Museum Exhibit Collaborative, consisting of: the Franklin Institute Science Museum, Philadelphia, PA; Discovery Place, Charlotte, NC; the Fort Worth Museum of Science and History, Fort Worth, TX; the California Museum of Science and Industry, Los Angeles, CA; the Science Museum of Minnesota, St. Paul, MN; the Museum of Science and Industry, Chicago, IL; the Center of Science and Industry (COSI), Columbus, OH; and the Museum of Science, Boston, MA. Each has contributed $50,000 and the costs of exhibit shipping and maintenance. Direct matching fund support totals more than $381,000.

The exhibit will spend three months in each location, and the total audience will exceed 1.5-million visitors over its eight museum tour.

RESEARCH IN TEACHING AND LEARNING

Minda Borun	MDR 8751396
Franklin Institute	FY88 $129,803
Philadelphia, PA	Museums

"Naive Knowledge and the Design of Science Museum Exhibits"

The investigation of naive conceptions of science has many implications for both teaching and learning. The predominant model for past investigations has been with school children or within very formal settings. Extending investigations of misconceptions to informal settings is the challenge of this research.

Museum visitors' misconceptions about two topics, gravity and mechanical advantage, will be recorded through a variety of interview formats. Twenty-five persons from each of the age ranges 9-11, 12-14, 15-18, and college students/adults will be interviewed. Information from the interview will be used to modify the current exhibit or to build new prototypes. The research will determine if a modification can be made that results in individuals moving from their previous misconceptions toward a correct conceptualization of the concepts. This research will document what individuals actually learn from museum exhibits and how "front end evaluation" can be used to redesign exhibits for maximum concept learning.

The proposed research is challenging and has the potential of adding significant information to science education research on misconceptions.

INFORMAL SCIENCE EDUCATION

Daniel L. Goldwater	MDR 8652305
Franklin Institute Science Museum	FY87 $324,460
Philadelphia, PA	Museums

"Mathematics - An Exhibit on Ideas and Applications"

The Franklin Institute Science Museum, a major American Science Center serving more than 700,000 individuals annually, proposes to create a 3,700 square foot permanent exhibition that will promote public interest in and understanding of the concepts and principles of mathematics in concrete, tangible form. The exhibition will consist of five clusters of hands-on devices, interactive computer programs, models, and text on the themes of Geometry; Symmetry; Chance, Probability and Randomness; Series, Sequences and Limits; and "Modern Math"--Fractals, Knots and Braids, and Topology.

Museum staff will utilize several mathematicians as advisors and design participants and will develop adjunct educational materials for use by teachers, students, and family members. They will disseminate exhibition techniques and content by providing six collaborating museums with selected copies of exhibit devices and hardware for their use in developing temporary or permanent mathematics exhibits. Staff of the six museums will join advisors for a design conference during exhibition planning, and will provide evaluation reports on their use of the exhibit materials.

Knowledge of mathematics is not only necessary for everyday life; it is central to public understanding of science and engineering, and a key to continued participation in science education in high school and college.

Increasing national interest improvement in the mathematical ability of Americans at all levels, pre-college and college, make this proposed exhibition particularly timely.

INFORMAL SCIENCE EDUCATION

Jane H. Horwitz	MDR 8751820
Franklin Institute	FY88 $301,795
Philadelphia, PA	Elem Science

"Girl Scout Leader Training Program"

The Franklin Institute Science Museum will, over a three-year period, develop a regional Girl Scout leader training program that provides science education experiences for Girl Scouts. The Girl Scout Council of Greater Philadelphia and the Washington Rock, NJ Council will be primary partners and the source of volunteer leaders and the target audience of member girls. Science Education kits will be developed and tested for Brownies and Juniors, training materials for staff trainers and volunteer leaders developed, leaders trained, and several post-training support mechanisms developed. Program materials are designed for continued use by the Girl Scouts; more than 2,000 leaders will be trained and 20,000 girls will participate in project activities during the three-year period.

This project is directed at the substantial under representation of women in many science and engineering fields by working with girls in informal settings to overcome patterns of science and mathematics avoidance. Replication and dissemination will be undertaken both within the Girl Scout Council system and among museums, youth organizations, and other informal educators. The proposers are contributing nearly $250,000 in resources to the project; NSF support will be 55% of the project total.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Wayne Ransom	MDR 8751401
Roree Iris-Williams	FY88 $344,471
Franklin Institute Science Museum	FY89 $309,811
Philadelphia, PA	Elem Science

"The Philadelphia Elementary Science Activity Kit Collaborative"

The Philadelphia Elementary Science Kit Collaboration (PESKC) of The Franklin Institute is a model urban alliance that includes the museum, local corporations and the School District of Philadelphia. Since 1983 this partnership has successfully piloted hands-on science kits and workshops to support the use of activity kits in the K - 6 classrooms and to increase the content area preparation of elementary teachers. PESKC has four primary goals:

-- to develop and produce twenty-eight science activity kits that will augment and support four major curriculum goals.

-- to provide professional development workshops for Philadelphia teachers to train them in the effective use of the kits and to improve their competence and confidence as science educators.

-- to expand a network that will link elementary teachers to science resources in the local community.

-- to continue an active program for dissemination of kits and urban partnership model to defray development cost and support the replication of the program in urban and other communities across the nation.

COLLEGE SCIENCE INSTRUMENTATION

Kenneth R. Hess	USE 8851677
Franklin and Marshall College	FY88 $32,773
Lancaster, PA	Chemistry

"Applications Development for an Ion Trap Detector at an Undergraduate Level"

Gas Chromatography/Mass Spectroscopy (GC/MS) is being integrated into the undergraduate laboratory experience. Current literature in Analytical Chemistry reveal a growing dependence upon GC/MS techniques, especially in the areas of Environmental Protection Agency priority pollutant analysis and in the rapidly expanding field of drug analysis. Exposure to such a system at the undergraduate level would be an advantageous introduction to advanced methods of chemical analysis. In particular, the Ion Trap System available from Finnigan MAT is being employed. This recently introduced instrument has several potential advantages for use at the undergraduate level including increased durability and lower maintenance than corresponding quadropole or magnetic sector mass spectrometers and simplified operation through complete computer control. These factors are of primary importance for the undergraduate laboratory where the system is subjected to users with varying degrees of competence. The Department has recently converted the organic laboratory to microscale which results in an inherent dependence upon advanced instrumentation for analysis. The high selectivity and sensitivity of the GC/MS system is ideally suited for microscale analysis and the Ion Trap System is being incorporated into the Sophomore year Organic Chemistry for analysis of student-prepared compounds. Additionally, the instrument is being employed in Junior year Analytical Chemistry for the separation and analysis of multicomponent mixtures and for an introduction to computer controlled instrumentation through programming in FORTH language. The instrument is also becoming an integral part of the strong research program, allowing more efficient utilization of the instrument with year-round use.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Mark Wagner USE 8750413
Franklin and Marshall College FY87 $16,699
Lancaster, PA Psychology

"A Research-Intensive Approach to Undergraduate Education in Psychology"

This Department is purchasing several pieces of equipment to: (a) support recent curricular changes, (b) replace antiquated existing equipment and (c) allow majors access to research experiences that are difficult or impossible to obtain with current holdings. There are four basic types of equipment:

(1) audio equipment -- a 6W speech analysis system and Ensonique sound synthesis system to allow students to modify and analyze human speech, environmental, musical, and animal sounds in a wide variety of course and independent research settings; (2) video equipment -- the Gerbrand presentation system and Coreco Image processor to allow students to create, flexibly present, and analyze visual images for the study of human cognition and perception; (3) the Biocomp 2001 to allow students to measure the physiological indices of arousal relevant to both biological psychology and social-personality; (4) artificial intelligence -- a Hero 2000 robot and NEXPERT expert system shell to allow students research experience with two of the most burgeoning areas of inquiry in science today -- robotics and artificial intelligence. The Department has already had considerable success with its research- oriented approach. The equipment will allow the Department to fully implement this approach.

COLLEGE SCIENCE INSTRUMENTATION

Samuel L. Hazen USE 8750876
Gannon University FY87 $46,170
Erie, PA Electrical Eng

"Development of an Undergraduate Computer-aided Design and Test Laboratory"

In this project, a modern, computer-aided design and test laboratory will be constructed. It will include ten integrated electrical engineering workstations consisting of an interconnected IBM PC/XT with Hewlett Packard electronic benches attached. These workstations will be used to teach modern computer-aided testing, measurements and experimentation in circuits, electronics and advanced laboratories. The result is expected to be a significant improvement in the laboratory education of electrical engineers.

COLLEGE SCIENCE INSTRUMENTATION

Felicia Corsaro-Barbieri USE 8750069
Gwynedd-Mercy College FY87 $7,400
Gwynedd Valley, PA Biology

"Integration of Biochemical Analysis Techniques into an Undergraduate Biology Curriculum"

In order to increase and modernize the Biology majors' expertise with biochemical instrumentation, a three-step project is being undertaken: techniques of analytical chemistry are being introduced earlier into the Biology curriculum; students are being exposed to more current and sophisticated techniques through the acquisition of a high-performance liquid chromatography system and ultraviolet-visible spectrophotometers; and the Biochemistry laboratory course is being converted from a survey of biochemical reactions to a course that includes a significant exposure to modern biochemical techniques.

Biology graduates who are familiar with these additional instrumental techniques are expected to have a deeper understanding of major issues in modern Biology and thus to be able to compete successfully for positions in graduate and professional programs of study and for employment opportunities.

COLLEGE SCIENCE INSTRUMENTATION

Richard Ciocci USE 8852855
Harrisburg Area Community Col FY88 $98,394
Harrisburg, PA Mechanical Eng

"CAD/CAM Manufacturing and Automated Processing Laboratory"

This project supports the Mechanical Engineering Technology program and a new program in Manufacturing and Design. Students of manufacturing and design, mechanical, industrial automation and electronic engineering technology study the concepts and techniques of computer-integrated processing and the interfacing necessary for computer-assisted functions. Utilizing workcells, students experiment with production operations in the laboratory. The laboratory supporting this project includes the following equipment: three CNC machine tools (one mill and two lathes) linked to the CADAM system for CAD/CAM production, integrated with robots, microprocessors and programmable logic controllers. Manufacturing precision is verified with an optical comparator and manual gages. Students are trained as technologists in this state-of-the-art laboratory to serve a critical need in the Nation.

This award is matched by an equal amount from this institution.

COLLEGE SCIENCE INSTRUMENTATION

M. Kaye Edwards USE 8750418
Haverford College FY87 $50,000
Haverford, PA Biology

"Acquisition of a Transmission Electron Microscope for Undergraduate Instruction and Research"

Through this project, the Biology Department of Haverford College is purchasing a modern transmission electron microscope to support undergraduate instruction and research. All biology majors learn to operate the new Hitachi H-600-3 in their Junior year as part of an intensive laboratory course in cell and molecular biology. The technical and analytical skills gained in this course form the foundation for further work in independent Senior research courses, which regularly result in scholarly publications co-authored by students. Five faculty members in addition to the Principal Investigator will sponsor undergraduate investigations employing this sophisticated instrument.

COLLEGE SCIENCE INSTRUMENTATION

M. Bernice Andrelczyk USE 8750597
Holy Family College FY87 $26,500
Philadelphia, PA Chemistry

"Improving Undergraduate Instruction in Organic Chemistry Through Proton NMR Spectrometry"

A recently acquired NMR Spectrometer is being used extensively in the area of organic chemistry but also throughout the chemistry curriculum at Holy Family College in the preparation of students for industry, graduate school, teaching, pre-medicine, pre-pharmacy, medical technology and the allied health professions.

TEACHER ENHANCEMENT PROGRAM

John W. Butzow TPE 8751295
Indiana University of Pennsylvania FY88 $417,910
Indiana, PA Computers

"ExCELS: Expansion of Computer Education in Learning the Sciences"

This project will provide about 60% of the funding for a third and fourth year extension of a previously funded teacher development project entitled "Expansion of Computer Education in Learning the Sciences", (ExCELS). The remaining funds for the project will be provided by Indiana University of Pennsylvania and the school districts of the participating teachers.

Leadership training in both content and pedagogy will be provided for two separate groups of 60 science and mathematics teachers/coordinators during the summers of 1988 and 1989. Following the summer workshop, participants will implement project developed activities in their own classrooms, and subsequently provide inservice programs for their peers which will enable the peers to implement computer use into the teaching of their academic disciplines. Science participants will be selected from the disciplines of biology, chemistry, physics, and earth science, and mathematics participants will represent teachers from the entire grade range, K-12. The acquisition of the necessary hardware and software, as well as support for the post summer inservice programs conducted by the participants, will be provided by the school districts. An electronic mail network will provide mutual support for the participants as they implement the activities in their classrooms and provide inservice instruction to their peers.

This proposal is meritorious for funding because of the quality of work produced in the phases already funded, the well-thought out plan for extending the expertise of the participants to their peers through inservice workshops, the emphasis on the use of technology in relevant science instruction, and the interdisciplinary thrust of relating science and mathematics in the school systems involved. The production of a resource book on the activities involved will provide further dissemination and adoption of the project results.

COLLEGE SCIENCE INSTRUMENTATION

John N. Fox USE 8750009
Indiana University of Pennsylvania FY87 $9,147
Indiana, PA Physics

"Sputtering Facility for Undergraduate Students"

The Department of Physics at Indiana University of Pennsylvania will purchase a sputtering system and associated equipment which will become a part of a new high vacuum system. The present system, purchased with local funds, contains resistive heating and electron beam evaporators. The addition of the sputtering system will allow students to learn about this important technique and to study properties of amorphous thin films, properties of optical coatings, the preparation of interesting Hall effect films, the fabrication of semiconductor devices, and to use materials which have not been accessible with present techniques.

COLLEGE SCIENCE INSTRUMENTATION

Vythilingam Wijekumar USE 8851861
Indiana University of Pennsylvania FY88 $10,399
Indiana, PA Physics

"CAMAC (Computer Automated Measurement and Control) Based Data Acquisition System for the Undergraduate Nuclear Physics Laboratory"

The Physics Department will improve the undergraduate Nuclear Physics curriculum by giving students hands-on experience in the latest state-of-the-art technology in real-time data acquisition, monitoring and control that is used not only in the area of Nuclear Physics, but also in the chemical industry and in the medical field. The purchase of a CAMAC system will be the first step toward this goal. This system includes a CAMAC crate, a crate controller, three CAMAC modules (analog to digital converters) and an IBM PC/AT compatible PC with associated software for data acquisition. The CAMAC system will be used in the advanced undergraduate Physics laboratory to acquire, monitor and control data in nuclear physics experiments. Since this system has found widespread use in industrial, research and medical applications, this equipment will better prepare undergraduate Physics students for graduate school and industry.

This award is being matched by an equal amount from this institution.

TEACHER ENHANCEMENT PROGRAM

Donald J. Mitchell TPE 8751458
Juniata College FY87 $ 12,920
Huntingdon, PA FY88 $160,779
FY89 $143,800
FY90 $104,963
FY91 $ 78,040
Chemistry

"Central Pennsylvania Chemistry Teachers Science Education Improvement Project"

Juniata College will conduct a five-year program including 1) 6 weeks plus 2 weeks of summer institutes for a total of 120 in-service teachers on the pertinent theory and use of modern chemical instrumentation with ample opportunity for hands-on experience, 2) an opportunity for teachers to work as research scientists within a research group directed by a Juniata faculty member, 3) a mobile chemistry instrumentation laboratory staffed by a properly trained, certified science teacher who will work with participating teachers and deliver modern instrumentation for use in the schools, and 4) the development of a network of well trained science teachers throughout the target region to ensure systemic and lasting program impact. The project specifically targets science teachers in a four-county region of rural, central Pennsylvania and focuses primarily on chemistry. This project is designed to help pre- college science teachers perceive themselves as scientists as well as teachers, to provide them with the training and support to improve their performance as scientist-educators, and to help them produce better science students and increased student interest in science careers.

COLLEGE SCIENCE INSTRUMENTATION

Dale L. Wampler USE 8750290
Juniata College FY87 $37,930
Huntingdon, PA Computer Science

"Unix C and Graphics Upgrade of the Undergraduate Computer Science Program"

The project will improve six upper level courses of the computer science program. The improvement will be made possible by the purchase of four workstations and one file server that are Unix based and feature high resolution graphics displays. The availability of Unix and C will allow students to attack more significant software projects in Operating Systems, Programming Languages and Compiler Construction. Students in Computer Graphics will be able to perform more sophisticated graphics modeling and access standard graphics libraries in their software projects. Students in the Computer Science Senior Research Courses will be able to perform experiments on system parameters and performance because a given student will be able to have exclusive control at a workstation for blocks of time. Experience with Unix is becoming crucial because of its dominance as an operating system used in graduate programs. Furthermore, experience with Unix, C, high performance graphics workstations and networked systems is very advantageous to graduates entering professional computer science careers today.

COLLEGE SCIENCE INSTRUMENTATION

Thomas S. Lillie USE 8851625
Lafayette College FY88 $86,150
Easton, PA Physical Sciences

"Incorporation of Fourier Transform Nuclear Magnetic Resonance (FT NMR) Spectroscopy into the Undergraduate Physical Science Curriculum"

This project introduces contemporary Nuclear Magnetic Resonance (NMR) Spectroscopy into the Physical Science curriculum by acquisition and use of a high-field FT NMR spectrometer. Major advances over the past decade have transformed this technique into a fundamental tool of chemistry and physics, as well as a cornerstone of emergent medical technology (NMR imaging). Available equipment is both accessible to nonexperts and capable of performing such previously difficult or impossible tasks as high-field NMR, 2-D NMR, and relaxation measurements. With this equipment the students -- a substantial number go on to careers in science, medicine and industry -- have hands-on experience with equipment and techniques they will encounter later. The use of FT NMR spectroscopy is integrated into the core Chemistry and Physics curriculum, which is also critical to majors in related fields. Improved classes and laboratories, together with existing faculty expertise, serve to enhance student research.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Dana P. McDermott USE 8750822
Lafayette College FY87 $19,200
Easton, PA Chemistry

"FT-IR for Upper Division Undergraduate Chemistry Laboratories"

A recently acquired Fourier Transform Infrared Spectrophotometer (FTIR) is being used in the laboratory programs in Analytical, Organic and Physical Chemistry at Lafayette College. Experiments hitherto not possible, such as analyses of residues in extracts from contaminated soils, studies of structural changes of compounds upon interaction with solvents, and studies of very rapid decomposition reactions, are being carried out. Contrasting the capabilities of FTIR with dispersive infrared spectrophotometry in these cases gives a deeper understanding of the inherent superiority of FTIR and of certain aspects of instrument development. In addition, the availability of FTIR is increasing student-faculty research activities, thus strengthening the professional training of chemistry majors. At Lafayette College, a large proportion of these are women.

COLLEGE SCIENCE INSTRUMENTATION

David J. Cichowicz USE 8750760
La Salle University FY87 $11,500
Philadelphia, PA Chemistry

"Incorporation of Fourier Transformation Methodology into La Salle University's Undergraduate Chemistry Curriculum"

As a result of the massive technological reform which has taken place during the past ten years, virtually every academic and industrial research institution now obtains infrared spectra through the use of Fourier Transform instrumentation. To adequately prepare students who hope to pursue research-oriented careers, the Department of Chemistry at La Salle University has recently acquired a Fourier Transform Infrared (FTIR) Spectrophotometer which is being used by junior and senior chemistry majors as an integral part of four courses in the undergraduate curriculum: Advanced Quantitative (Instrumental) Analysis, Qualitative Organic Analysis, Advanced Inorganic Chemistry, and Senior Research. Through this experience, undergraduates are better able to understand the Fourier Transform method, learn how to perform peak searches in existing FTIR spectra libraries, and utilize IR spectroscopy as a quantitative technique.

COLLEGE SCIENCE INSTRUMENTATION

Richard D. Cornelius USE 8851260
Lebanon Valley College FY88 $16,566
Annville, PA Chemistry

"The Introduction of an Atomic Absorption Spectrophotometer into the Chemistry Curriculum to Strengthen Laboratory Instruction"

A Varian SpectrAA-10B Atomic Absorption Spectrophotometer and an accompanying computer-based data station is being used to introduce the principles and techniques of atomic absorption spectrophotometry into the curriculum at a number of levels. Specific course improvements being made include: Introduction of the atomic absorption method into Introductory Chemistry as a technique for the determination of the sodium content of over-the-counter medications and for the determination of the lead content of solutions of lead iodide; Demonstration of the principles of operation of an atomic absorption spectrophotometer and its analytical applications in an Instrumental Analysis course; and Use of atomic absorption spectrophotometry in independent study and in summer research programs. The equipment is also being used in the annual summer chemistry program for advanced high school students.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Owen A. Moe, Jr. USE 8750577
Lebanon Valley College FY87 $22,890
Annville, PA Chemistry

"The Introduction of a Gas Chromatograph/Mass Spectrometer into the Chemistry Curriculum to Strengthen Laboratory Instruction"

A Gas Chromatograph/Mass Spectrometer with an interfaced computer-based data station is being used by the Chemistry Department at Lebanon Valley College in the following activities:

- A qualitative organic analysis experiment during the first semester of organic chemistry;

- Measurement of reaction kinetics, determination of isotope exchange, and the determination of the fatty acid composition of natural fats in the second semester of organic chemistry;

- Demonstrating the principles of operation, and the analytical applications of GC/MS in an instrumental analysis course;

- Independent study, undergraduate summer research, and an annual summer chemistry program for advanced high school students.

COLLEGE SCIENCE INSTRUMENTATION

Sidney Pollack USE 8750769
Owen A. Moe, Jr. FY87 $26,107
Lebanon Valley College Biology
Annville, PA

"Ultracentrifuge and Electrophoresis Equipment for Undergraduate Instruction in Genetics, Molecular Biology, and Biochemistry"

Lebanon Valley College will strengthen its major degree programs in biochemistry and biology by incorporating a new experiment into an existing genetics course to demonstrate the principles of ultracentrifugation and its application to DNA purification; introducing a new advanced course in molecular biology; and implementing a new project-oriented sequence of experiments in an existing biochemistry laboratory course. In order to carry out this plan, Lebanon Valley College will acquire a Preparative Ultracentrifuge, Equipment for DNA Electrophoresis, a Microcentrifuge, and a Biological Safety Hood. The increasing importance of molecular genetics in both basic and applied biochemical research makes the introduction of its concepts and methodologies into the curriculum necessary.

COLLEGE SCIENCE INSTRUMENTATION

Allan F. Wolfe USE 8853192
Lebanon Valley College FY88 $21,462
Annville, PA Biology

"Improvement of the Undergraduate Comparative Histology Laboratory Experience"

Most of the students who enroll in the Histology course and its associated laboratory are Biology majors with plans to pursue graduate degrees or to attend professional schools. Historically, the laboratory part of this course included the study of prepared slides of various tissue types and organ systems, as well as the routine procedures for the histological and histochemical staining of paraffin- embedded tissues. The laboratory experience then culminated in a project which utilized some of the techniques learned in the course and was presented in a poster format.

Redesigning this course to improve laboratory study at the cellular biology level -- fluorescence microscopy, ultrastructural studies, immunohistochemistry, and plastic embedding -- provides Biology majors as well as Biochemistry majors with a strong morphological background at the cell level for their advanced molecular and biochemical courses. This improved course retains the study of basic tissue types, organ system histology, and the completion of a project. To make room for these proposed newer cell biology/histology techniques, a careful culling of prepared slides was required. Previously, the Histology course provided a large number of students with the impetus to pursue independent study projects. By expanding the exposure of more students to a wider variety of techniques, this program stimulates even greater interest in pursuing Cell Biology- or Histology-related projects.

The grantee institution is matching the NSF awarded with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Ellen P. O'Hara-Mays USE 8852123
Lock Haven Univ of Pennsylvania FY88 $11,389
Lock Haven, PA Chemistry

"Learning Chemistry as a Process: Chemical Kinetics"

An integrated approach by which the student is repeatedly presented with the concept of chemical kinetics in various courses. Each exposure to the concept is presented in increasing complexity. It is the goal of the Department to evaluate different methods of presenting this difficult concept. The faculty in each discipline have designed experiments which improve the laboratory curricula. In the Introductory and General Chemistry courses, a qualitative demonstration in lecture and semi-quantitative laboratory is being used. In Organic Chemistry, which is generally the second year of a chemistry program, a thorough examination of the mechanism and other chemical parameters (eg. steric hindrance) of a chemical reaction is being examined. The third year of the chemistry program includes Physical Chemistry where a more detailed calculus based description of the chemical kinetics is introduced to describe the mechanism and possible description of reaction intermediates using mathematical models. The fourth year of the chemistry program includes Biochemistry. The student is being introduced to enzyme kinetics where the mathematical descriptions emphasized in Physical Chemistry are being applied to biological catalysts and extrapolated to the processes occurring in living systems. Other courses in the chemistry program are also teaching these principles, but the contributing courses fall into a chronological sequence and utilize chemical kinetics in their curricula. The students who are benefitting from these programs are the Chemistry majors, the students who are taking general education courses, and those students with majors in Science Education, Health Science and Biology.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Arnold George	TPE 8751698
Robert A. Johnson	FY88 $188,004
Mansfield Univ of Pennsylvania	Chemistry
Mansfield, PA	

"Chemistry for Children: A Program for Elementary School Teachers in Precollege Chemistry"

Chemistry for Children: A Program for Elementary School Teachers in Precollege Chemistry will introduce experiences with chemistry at a level appropriate to elementary teachers with little or no background in chemistry, and will be presented in such a way that the teachers can translate the experiences into safe, hands-on, exciting activities for their students in elementary school. Twenty-five teachers will be given the educational experiences in three-week summer workshops in each of two summers and an academic year one-week workshop at Mansfield University to act as resource persons for other teachers.

The project staff have previously completed an outstanding 150-page book of activities, "Chemistry for Children", and an accompanying in-service guide which will be further disseminated through this project.

INFORMAL SCIENCE EDUCATION

Jay Rayvid, Jr.	MDR 8652308
Joanna Baldwin-Mallory	FY87 $ 49,918
David L. Webster	FY88 $350,082
William Sanders	Broadcasting
Metropolitan Pittsburgh Public Broadcasting Inc	
Pittsburgh, PA	

"Time Travelers: Rediscovering the Past"

WQED and the Pennsylvania State University have created a new archeology series titled "Time Travelers: Rediscovering the Past". This eight-part series will present in compelling terms the recent scientific innovations in archeology and how new techniques have added startling insights into past civilizations.

The programs are aimed at the general public and will reach an estimated 7,000,000 people. The series is thematically organized around vital issues such as: New Worlds; Great Spirits; Scribes and Subscriptions; The Artisan; Power and Prestige; The Hearth; Realms of the Maya; and Collapse. A major traveling museum exhibition will parallel the series and a trade book will be developed. The Annenberg/CPB project has authorized $2 million towards production and development of instructional materials for use as a college-level course.

WQED has an outstanding track record in development of television series. They have won over 100 national awards in the past ten years, including ten Emmys and a Peabody award. They have a distinguished Advisory Committee to oversee accuracy of content.

COLLEGE SCIENCE INSTRUMENTATION

Yin S. Soong	USE 8851450
Millersville Univ of Pennsylvania	FY88 $6,390
Millersville, PA	Geology

"Magnetic Tape Module for Processing and Archiving Satellite Image Data for Undergraduate Laboratories Using Earth Resources Data Satellite Images"

The grantee institution will purchase a 6250 bpi tape drive and associated software. This equipment will be used to upgrade courses in Meteorology, Oceanography, and Geology. With the equipment students will be able to read in Landsat and NOAA polar orbiting satellite data from standard magnetic tape to an existing Earth Resources Data Analysis System (ERDAS). They then will be able to archive processed images from ERDAS on tape for later analysis. Likewise students will use the tape system to capture sequences of weather satellite images for analysis.

The grantee will match the NSF award with an equal amount of funds.

NETWORKS PROGRAM

Barbara A. Barchi	TPE 8751239
Penn State Univ Central Office	FY87 $187,491
University Park, PA	FY88 $274,372
	FY89 $159,881
	Other NEC

"Research on the Development of a Nationwide Support Network for the Implementation of Science, Technology and Society (STS) Education in Junior and Senior High Schools"

This project proposes to facilitate the implementation of Science, Technology, Society (STS) Education in classrooms, grades 7-12, by linking together a nationwide, regionally-focused network of state education agencies, intermediate service units and local schools through a cadre of project-trained STS leaders with support from the extensive resource base of the STS Program at the Pennsylvania State University.

To accomplish this concerted effort, the project will:

* Create regional and state advisory committees of distinguished STS university leaders and state science and social studies supervisors, whose charge will be to identify STS initiatives and needs, and to facilitate access to existing resources and potential state inservice leaders.

* Train a cadre of 450 leaders at the school district and intermediate service unit level in a repertoire of teacher inservice models for STS instruction and then to serve as a continuing source of information and support to that group throughout the project.

* Develop the resource-sharing network in three ways: arrange for access to existing and new STS educational products and practices through a print and a computer retrieval system; provide ongoing professional support by the exchange of information through a computer conferencing system; integrate ethics and values studies components into the on-going activities of the network.

YOUNG SCHOLARS

Richard F. Devon	RCD 8850119
Gerard A. Hauser	FY88 $30,745
Penn State Univ Central Office	FY89 $30,745
University Park, PA	Engineering

"Computers Graphics and Research: An Interdisciplinary Pre-Engineering Program for High School Students"

The Computers, Graphics and Research Program (CGR) at Pennsylvania State University is designed to introduce senior high school students to the skills, research methods, ethics and careers of engineering in an intensive two-week residential program. The CGR program offers twenty-five students extensive interaction with faculty, teaching assistants and residence hall counselors in both formal and informal settings. The program is administered by the Summer Honors Academy of the University Scholars Program. In the tradition of past Summer Honors Academy programs, CGR grants two academic credits to the participants. Follow-up activities include an option for pursuing one additional credit.

APPLICATIONS OF ADVANCED TECHNOLOGIES

M. Kathleen Heid	MDR 8751499
Penn State Univ Central Off	FY88 $116,086
University Park, PA	FY89 $127,237
	FY90 $148,255
	Mathematics

"Computer-Intensive Curricula in Secondary School Algebra"

Algebra is the core of secondary school mathematics. It provides concepts, language, and reasoning methods that are essential tools for problem solving in science, technology, and every branch of mathematics. Computer graphic, numerical, and symbolic manipulation tools that are now widely available offer powerful new approaches to algebraic problem solving and to learning algebraic concepts, principles, and skills. Thus computing offers promise of an impressive advance in the scope and effectiveness of secondary school algebra.

This joint University of Maryland and Pennsylvania State University project will complete development, field testing, and evaluation of prototype instructional materials for an elementary algebra strand in secondary school mathematics that reflects appropriate integration of computer tools for problem solving, teaching, and learning. The primary responsibility for curriculum development will rest with the University of Maryland and the teacher preparation and evaluation of the field tests will be done by Pennsylvania State University. The final products will include model student text materials and computer software, guidelines for teacher preparation, analyses of student learning, and guidelines for evaluation of achievement in the coming computer-intensive environments for school algebra.

COURSE AND CURRICULUM

Mary McCammon	USE 8813779
Penn State Univ Central Off	FY88 $42,399
University Park, PA	Mathematics

"Revitalization of Calculus"

Fourteen mathematics faculty members from four Pennsylvania colleges and universities will develop a lean and lively syllabus for a freshman science and engineering calculus sequence. In consultation with other mathematicians, scientists and engineers, a core of essential material will be determined.

Existing software, computer technology and placement tests will be evaluated, and modified as needed. A test with related software and supplements for instructors which covers the central core of materials will be produced.

In the Fall of 1988, several aspects of the experimental syllabus will be taught by the instructors. Each participant will experiment with only a small part of the curriculum. In this way several content areas and approaches can be tested, while insuring that students are exposed to nearly all of the traditional calculus.

Penn State is cost-sharing over twenty-five percent of the project's cost.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

TEACHER ENHANCEMENT PROGRAM

Peter A. Rubba	TPE 8651678
Penn State Univ Central Office	FY87 $128,542
University Park, PA	Elem Science

"Renewal Activities in Science Education for Elementary Teachers in Central Pennsylvania"

Pennsylvania State University will renew and further develop the science knowledge base, science teaching competencies and attitudes toward teaching science of 55 K-6 teacher leaders from diverse central Pennsylvania school districts during a cooperative two-year project which includes a five-week Renewal Institute, five academic-year teacher planned meetings and, in the second year, dissemination to fellow teachers by teacher leaders with assistance from the project staff. After the two-year NSF funding cycle this cadre of 55 science teachers will be utilized by Penn State in the training of preservice science teachers to demonstrate science lessons and be recommended to assist university faculty for inservice activities for an area in which 39% of the elementary teachers teach little or no science.

Responding to the explicit request of the targeted participants, four junior high school science teachers will deliver the science content and process-based instruction for this program during which teachers will present, videotape, review and critique science lessons and create their own materials for a curriculum which includes life and earth science, chemistry and physics. Pedagogical instruction will be provided by the senior personnel.

In order to establish a supportive environment required for elementary science instruction, a week long Principal's Workshops required of all participating schools will provide a model of a good science program, the role of the principal in developing science programs and research findings on elementary school science. Evaluation will include examination of the instructional components and follow-up of the participants in their classroom as they teach science.

Cost sharing for Renewal Activities in Science Education for Elementary Teachers in Central Pennsylvania is assumed by Penn State U., the school districts, and the Pennsylvania Department of Education. Participants from this economically depressed, rural area will receive five hours of graduate credit in science.

COLLEGE SCIENCE INSTRUMENTATION

Alan J. Jircitano	USE 8750396
Pennsylvania State University	FY87 $7,431
Behrend College	Chemistry
Erie, PA	

"An Ultraviolet-Visible Computing Spectrophotometer for Laboratory Courses and Undergraduate Research"

In this project, a computer-interfaced diode array ultraviolet-visible spectrophotometer is being used by the Chemistry Department at Pennsylvania State University-Behrend College to enhance undergraduate instruction in analytical chemistry, inorganic chemistry, instrumental analysis, physical chemistry, and undergraduate research. Determination of the coordination number, geometry, and isomerization kinetics of transition metal complexes, rapid analytical measurements including analysis of Beer's Law deviations by second order comparisons with extensions to multicomponent analysis are experiments which the speed and data storage capabilities of this instrument make possible. Undergraduate research activities on iron-containing macrocyclic complexes and on the analysis and determination of wine phenols also utilize this sophisticated instrumentation extensively.

TEACHER ENHANCEMENT PROGRAM

Frank J. Swetz	TPE 8550425
Penn State Univ Capitol Campus	FY86 $108,214
Middletown, PA	FY87 $ 24,500
	Mathematics

"Mathematical Modeling in the School Curriculum: An Honors Workshop for Secondary Mathematics Teachers in the South-central Pennsylvania Region"

This Leadership Activities project will provide enhancement and professional development experiences for 35 exemplary secondary school mathematics teachers from the south-central Pennsylvania area. The overall project goals involve the updating and deepening of the participants' mathematical backgrounds and teaching methodology, the networking of the participants, the conduct of in-service workshops by the participants in their home schools, the dissemination of the project materials and results to nearby school systems, and the investigation of the modelistic approach within a well-planned documentation, assessment and evaluation effort.

Participants will be selected through recommendations provided by educational specialists in the Intermediate Units, which provide services to 72 school districts. Participants will study the theory and practice of mathematical modeling, as well as the teaching of school mathematics emphasizing mathematical modeling and problem solving during a 5-week workshop on the Capitol Campus. In small group sessions they will work together to apply their new understandings to develop plans and materials for implementing mathematical modeling into their own teaching. Further, they will collaboratively plan for the half-day workshop each is required to conduct for their school colleagues. During the Autumn follow-up, they will be observed and assisted by project staff in their own classrooms. They will conduct the workshop for peers, attend three half-day symposia on mathematical applications presented by guest industrial mathematicians, and prepare written reports of all project activities. The participants will be recognized and honored, and they will earn eight graduate credits.

COLLEGE SCIENCE INSTRUMENTATION

Suzanne P. Varimbi USE 8750834
Rosemont College FY87 $25,850
Rosemont, PA Chemistry

"NMR Spectrometry for an Improved Undergraduate Chemistry Program"

The quality of the chemistry program at Rosemont College has been enhanced by the recent acquisition of a nuclear magnetic resonance (NMR) spectrometer. The availability of this instrument is providing undergraduate students a broader experience with chemical phenomena and a realization of the potential of NMR as a powerful tool for further investigation. Implementation of these goals is accomplished in three steps: (a) introduction of the basic concepts of NMR spectrometry through experimentation followed by qualitative application to organic structure determination; (b) remodeling of the advanced laboratory sequence to include a series of comparative experimental projects using NMR and other complimentary techniques, and (c) development of applications to undergraduate research projects.

COLLEGE SCIENCE INSTRUMENTATION

Paul M. Tefft USE 8750549
St Joseph's University FY87 $22,985
Philadelphia, PA Biology

"Integration of Tissue Culture Techniques into the Undergraduate Biology Curriculum"

With equipment procured through this project, modern techniques of tissue culture are being incorporated into the Biology curriculum. In the sophomore course required of majors and in the five upper division courses, these techniques are being used, e.g., to carry out experiments in viral infection, plant and animal organ/tissue explantation, the formation of hybridomas, and plant and animal morphogenesis. The plant growth cabinet and the growth chambers provide environments for controlled experiments and for the propagation of living material used in the various labs.

Controlled environmental conditions are essential for many of the experiments. A contamination-free environment also is required to protect both the aseptic culture material and the students. A sterile and safe environment is being provided by the laminar flow hood. Finally, undergraduates now have modern phase contrast, inverted and fluorescence microscopes for use in their studies in Cell Biology and tissue culture.

COLLEGE SCIENCE INSTRUMENTATION

Gordon C. McIntosh USE 8852767
St Vincent College FY88 $5,361
Latrobe, PA Astronomy

"Computer Interfacing with Radio and Optical Astronomical Telescopes"

The grantee will acquire three Apple-IIGS Systems and a mounting for an existing 25 cm optical telescope. The computers will be interfaced with the optical telescope and an existing 5 meter radio telescope for control of telescope positioning and acquisition and analysis of data. In addition to student research and advanced laboratory courses, activities using the telescopes will be developed for application in the Introductory Astronomy, General Physics and Electronics courses offered by the Department of Physics.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Frank W. Fletcher USE 8851365
Susquehanna University FY88 $6,850
Selinsgrove, PA Geology

"An Electromagnetic Conductivity Meter for Undergraduate Laboratories in Groundwater Resource and Contamination Evaluation"

This project provides for purchase of an electromagnetic conductivity meter and data digitizer which will be used to improve instruction in courses in Geohydrology. Students will carry out extended projects in groundwater resource evaluation and measurements of groundwater contamination. The instrumentation also will be used in research projects by advanced undergraduates for Senior theses.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Richard W. Kozlowski USE 8851978
Susquehanna University FY88 $7,123
Selinsgrove, PA Physics

"Fiber Optics and a Sophisticated Spectrometer in an Undergraduate Physics Program"

This project provides for purchase of fiber optics kits and components for the construction of an optical spectrometer. This equipment will be used to improve instruction in the upper division Physical Measurements Laboratory. The spectrometer will be specially designed for teaching Spectroscopy. Students will use the fiber optics equipment to gain a basic understanding of this new technology, while the optical spectrometer will be used to instruct students in the basic principles underlying this widely used type of instrument.

The grantee will match the NSF award with an equal amount of funds.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Eugene A. Klotz MDR 8550459
Swarthmore College FY86 $332,833
Swarthmore, PA FY87 $255,420
Mathematics

"Visual Geometry: A Multi-Media Approach"

This project will develop video, computer, and print materials that will enhance the teaching of geometry in secondary schools. The central medium will be broadcast-quality videotapes, which will consist of computer generated animation accompanied by narration and some text. Workbooks will allow the video materials to be used either for classroom instruction or for independent study. Related computer programs, together with high quality documentation, will also be developed, allowing students to explore geometric concepts interactively.

A useful byproduct of the project will be a "geometer's sketch pad", a program that will enable geometers working with inexpensive microcomputers to sketch geometric figures in two and three dimensions and to apply geometric transformations that will permit visualization from different perspectives. This program will be used by the project staff for prototyping animation sequences. It will also be of interest to other mathematicians and will be appropriate as an instructional tool for use with gifted students.

COLLEGE SCIENCE INSTRUMENTATION

Frank A. Moscatelli USE 8852201
Swarthmore College FY88 $30,964
Swarthmore, PA Physics

"Laser Atomic/Molecular Spectroscopy Laboratory for Undergraduate Instruction"

The Physics Department will develop a laser atomic molecular spectroscopy laboratory for undergraduate instruction. The facility will include a pulsed tuneable dye laser, a boxcar averaging system for time resolved detection, a tuneable CW laser, a double spectrometer for recording high dispersion spectra, and provisions for upgrading an existing apparatus as a versatile atomic beams device. The laboratory will make extensive use of computer interfacing and control. Activities in the lab will cover a wide range from simple demonstrations and observations to routine experiments associated with our advanced courses to student research projects and theses. Typical experiments include Raman spectroscopy, investigations of the optogalvanic effect, atomic and molecular life time measurements, non-linear spectroscopy, Doppler free atomic beam spectroscopy, two-step excitation of Rydberg atoms, and observations of coherent transient phenomena.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Stephen M. Platt	USE 8750799
Swarthmore College	FY87 $19,738
Swarthmore, PA	Electrical Eng

"A Graphics Workstation Laboratory for Upper-Level Undergraduate Engineering Education"

The Engineering Department of Swarthmore College will create a laboratory facility to introduce workstation and computer graphics as integral parts of the engineering curriculum. This state-of-the-art graphics environment will support upper level courses in the fields of Civil, Mechanical, Electrical and Computer Engineering. Apollo workstations will be used with integrated graphics capability. This experience at the undergraduate level will help the students understand how engineering is done in practice.

COLLEGE SCIENCE INSTRUMENTATION

Faruq M. Siddiqui	USE 8851669
Swarthmore College	FY88 $14,132
Swarthmore, PA	Mechanical Eng

"Enhanced Engineering Materials-Evaluation Laboratory"

This project enhances the existing materials laboratory by incorporating: a PC-based multi-channel stress-strain-temperature data acquisition and display system that permits more insightful student analysis of material response to static and low-frequency dynamic loading; and, integrating a CCTV display system with an inverted metallograph and other optical equipment, permitting classroom demonstration and group laboratory examination of microstructures and fracture surfaces.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

Robert M. Aiken	TPE 8850521
Glenn E. Snelbecker	FY88 $357,042
Temple University	Computers
Philadelphia, PA	

"A Model Program for Retraining Elementary and Middle School Teachers to Use Computers Effectively in the Classroom"

The main goals of the project are to provide, over a three-year period to fifty elementary and middle school teachers, five graduate level computer courses to establish a firm base of computer knowledge; and to apply the didactical structures to enable the teachers to become computer specialists in their respective schools and districts. A model has been developed by the principal investigators to retrain teachers at the grade levels K-9. An aspect of this proposal is to explore the efficacy of the model. The model includes, in addition to the content and methodology courses, seminars for elementary and middle school principals; seminars for the presidents of the home and school associations; establishment of a teacher network for the exchange and dissemination of ideas and materials; design of assessment criteria, evaluation instruments, and questionnaires for acquiring formative data; and assessment of the extent to which aptitude, attitude, and previous experience are useful as predictors of performance. The main programming languages integral to the program are Logo and BASIC. The work is a cooperative effort by the departments of Computer Science and Educational Psychology at Temple University; the Philadelphia School District is a close collaborator.

Participants for this project are teachers at the elementary and middle school levels selected from the School District of Philadelphia. An announcement is sent to each of the schools in Philadelphia with information on how to apply. Selection criteria are based upon teacher motivation to work with computers, their future professional plans, and their ideas on how to apply the results of the program to their schools.

The courses offered fall into five categories: Application programs and how to use them; Introduction to problem solving with Logo; Problem solving with advanced Logo; Problem solving using structured BASIC; and Software evaluation and effective uses of computers for teaching. These courses will be distributed over the three years of the project as the model dictates.

There is considerable cost sharing provided by Temple University. The University has committed $216,740 to the project, which is over 60% of the amount requested from NSF.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Leroy W. Dubeck	MDR 8650104
Temple University	FY86 $18,900
Philadelphia, PA	FY87 $ 2,330
	FY88 $ 3,780
	Films

"A Nationwide Publication for Science Teachers: Teaching Science Through Science Fiction Films"

This project has created a student workbook and teacher's guide that is enabling ninth and tenth grade teachers to incorporate science fiction films into their teaching of general science. Careful pre- and post-testing of the students using the materials is taking place. The project staff would like to prepare the analyses and results of these tests for publication; this supplement will permit them to do so.

The cognitive level of early adolescents is certainly not well understood. The supplement to this project will add valuable information to the cognitive development knowledge base.

TEACHER ENHANCEMENT PROGRAM

Leroy W. Dubeck	TPE 8652294
Temple University	FY87 $62,170
Philadelphia, PA	Films

"Interdisciplinary Teacher Enhancement Program Utilizing Science Fiction Films"

The purpose of this proposal is to improve the teaching of science at the junior high and senior high school levels by training teachers to use science fiction films as a supplement to the regular curriculum. Such an approach supports the classroom teachers' efforts to teach science and its relationships to technology and society and to motivate pre-college students to study science.

Two recent NSF grants funded the preparation of a teacher's guide describing the physical principles illustrated or violated in a number of science fiction films deemed suitable for use in a ninth or tenth grade general science course. This proposal will make use of both the materials and techniques developed under the prior grants.

Master teachers and non-master teachers will receive intensive instruction in the use of science fiction films and in a number of substantive topics in physics and biology related to the films during a two-week institute during the summer. Each team of three teachers will have the support of one master teacher as they implement the program in their classrooms during the school year.

The principal investigator has a great deal of expertise in this area. He was awarded an NSF grant in 1978 under the Local Course Improvement Program to develop an introductory level science course at Temple University using science fiction films to introduce students to science. This popular course has since been taught nine times and has reached hundreds of students, many of whom have stated that they would never have enrolled in a traditional science course. In 1984 an additional NSF grant allow him to expand the effort to include precollege students. The teachers guide written as a result of that grant will be used to support the training of teachers in the current grant.

CAREER ACCESS OPPORTUNITIES

Antonio Goncalves	USE 8850629
Fredrick M. Stein	FY88 $100,000
Temple University	FY89 $100,000
Philadelphia, PA	Minority Centers

"A Regional Center to Improve Minority Access to Education and Careers in Science, Engineering and Mathematics in the Greater Philadelphia Region"

This prototype project includes several activities to strengthen minority education from junior high school through the baccalaureate degree. It was developed as a cooperative effort among a number of colleges and universities, school districts, educational support organizations, community groups, unions, and corporations in the Philadelphia area. During the first year of operation, a set of activities, based on science and mathematics experiences, and designed to nurture, encourage and motivate minority students, are being implemented. These include an intensive faculty mentoring program to encourage community college minority students to continue on to the baccalaureate degree. These mentors provide career information, plan and supervise field trips, arrange visits to scientists and engineers in their work places, integrate students into support services and tutoring, and advise students about their course of study. Additional mentoring is provided by minority student support groups that will provide volunteer minority tutors and organize talks by minority scientists. Undergraduate research experience is provided through targeting selected community college students in their sophomore year. Precollege student activities from junior high through high school center around enrichment programs including special workshops in mathematics, science, and communication. To augment these activities each student's school is matched with an industry and/or government agency to provide invaluable resources such as role models, demonstrations, speakers, field trips, etc.

COLLEGE SCIENCE INSTRUMENTATION

Joyce M. Cuff	USE 8851777
Thiel College	FY88 $7,387
Greenville, PA	Biology

"Molecular Physiology Equipment for Undergraduate Laboratories and Independent Study"

Seven courses in the Biology curriculum have been targeted for inclusion of a molecular physiology component, both because of the role played by Molecular Physiology in modern Biology, and because these seven courses involve both majors and non-majors at all levels of undergraduate education. Two spectrophotometers with flowcell, thermoelectric cell, and recorder interface, and one strip chart recorder now are enabling students (a) to perform experiments in enzyme and transport kinetics, (b) to conduct a variety of metabolic studies, and (c) to pursue aspects of molecular physiology in their independent research projects.

These experiences better inform undergraduate students about contemporary Biology and better prepare majors for advanced studies, teaching careers, and professional work.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COURSE AND CURRICULUM

John D. Keenan	USE 8854527
University of Pennsylvania	FY88 $80,298
Philadelphia, PA	FY89 $83,139
	FY90 $ 9,442
	Civil Eng

"Development of a Curriculum in Civil Engineering Systems"

A new undergraduate program in civil engineering systems (CES) has been instituted as a means of equipping the civil engineering student to deal with the broader aspects of the profession. The CES program emphasizes the complex nature of civil engineering problems. This project completes the curriculum development with a new course in Structural Systems and the integration of computer-aided design (CAD) concepts into the curriculum. The objective of the course in structural systems is for the student to understand the structural/construction phase as a true system. A new CAD course is an integral part of the CES curriculum. The CES curriculum is a significant departure from conventional civil engineering education, but one which the engineer of the next century will need to understand. Matching funds committed by the institution are more than three-fourths of the amount of NSF funds for this project.

This project is co-funded with the NSF Directorate for Engineering.

TEACHER ENHANCEMENT PROGRAM

F. Bruce Robinson	TPE 8751336
Douglas F. Ryan	FY88 $216,722
Jean M. Roberts	Ecology
University of Pennsylvania	
Philadelphia, PA	

"Strengthening Middle/Junior High School Science Education"

The Biology Department, the Morris Arboretum, and the Plant Science Institute of the University of Pennsylvania propose to improve the quality of middle/junior high school science teaching in the Delaware Valley, and to build a summer enrichment science "academy" for ninth and tenth graders which will be a laboratory school for future teacher programs.

During the summer of 1988, an intensive four-week workshop will be held for 30 teachers. Ecology will be used as the means of exploring the scientific method, and each teacher will be required to develop a curriculum unit. During the academic year the units will be completed and field-tested. The best units and teachers will be selected to create a summer science academy for students the following summer.

During the summer of 1989, a second workshop based on the previous summer will be offered to 15 additional teachers. It will be run concurrently with a science academy for 30 to 45 middle school students taught by teacher participants from the previous summer. During the academic year, fifteen additional units will be completed and tested. The best units will be incorporated into the curriculum of the next summer program.

This project has a number of features which justify its funding as a Teacher Enhancement project. The following are the more significant:

1.The project will attempt to update participants' background material and teaching strategies by immersing them in the informal atmosphere of an arboretum;

2.A program will be developed to encourage promising students to be involved in science activities during the summer;

3.Information will be supplied with respect to the success of outdoor field activities in modifying the curricula of the middle schools; and

4.The project can be a model for other locations.

TEACHER ENHANCEMENT PROGRAM

Henry B. Cohen	TPE 8550031
University of Pittsburgh	FY85 $128,580
Pittsburgh, PA	FY86 $ 97,837
	FY87 $ 75,441
	HS Science/Math

"Community of Scholars Institutes in the Natural Sciences and Engineering"

This project will provide enhancement experiences for selected high school sciences and mathematics teachers through an intensive eight-week summer program at the University of Pittsburgh. About 40 teachers each year will improve their knowledge base and their teaching approaches through a scholars-in-residence activity.

The project activity is built upon the "college in high school" program, a cooperative teacher enhancement activity involving over 50 area high schools. The project staff are highly qualified and committed to providing substantive, stimulating experiences for improving secondary mathematics and science teaching.

Faculty mentors from biological sciences, chemistry, civil engineering, mathematics and statistics, physics and astronomy, and psychology will guide the small groups of 5 to 6 teachers in developing basic familiarity with current research work in the discipline. They will work intimately with university research teams of faculty and graduate students in the context of ongoing research. The teams will identify topics and techniques drawn from ongoing research which may be incorporated into secondary school curricula. With the aid of faculty from the School of Education, the teachers will develop and implement school instructional materials based upon their new knowledge. These materials will be refined and disseminated, along with results of the teacher implementations, through an existing tri-state schools council supported by area school systems and the university.

In the first week of each summer, the teacher scholars-in-residence will be joined by about 150 area teachers for a special Science Update Week. These lectures and workshops will be presented by the cooperating departments and the teacher participants from prior years.

APPLICATIONS OF ADVANCED TECHNOLOGY

Lauren B. Resnick	MDR 8470339
University of Pittsburgh	FY85 $301,406
Pittsburgh, PA	FY86 $309,986
	FY87 $321,969
	Mathematics

"Intelligent Tutors for Elementary and Middle School Mathematics"

This program of development and research provides theoretical foundations and prototype materials for improving the teaching of mathematical concepts and problem solving to elementary and middle school children. A set of graphic microworlds and prototype intelligent coaches will be built for the rational number system and for story problems, two topics in the school curriculum that are both pivotal for future learning and known to be difficult to teach.

In addition, a body of theory on the nature of intelligent tutoring will be developed and built into the tutors, and software tools to simplify the development of future tutors will be developed and made available to other researchers. The planned studies of children learning from the microworlds and coaches will provide a significant body of data and theory on the nature of mathematics learning. In particular, this work should lead to a new understanding of how children use multiple representations to develop abstract mathematical concepts, and contribute to the development of systematic ways to diagnose levels of mathematical understanding on the basis of various kinds of performance.

Through studying teachers' use of tutors, the project also will provide a set of computer-based tools that are explicitly aimed at upgrading teacher's knowledge of mathematics. At minimum, this part of the proposed work will insure the development of reasonable ways to prepare teachers to use the microworlds and coaches in their classrooms.

NETWORKS PROGRAM

Lauren B. Resnick	TPE 8751494
Gaea Leinhardt	FY87 $143,539
University of Pittsburgh	FY88 $311,291
Pittsburgh, PA	FY89 $287,680
	FY90 $304,214
	FY91 $ 57,766
	Mathematics

"Disseminating New Knowledge About Mathematics Instruction"

This project will develop a sustained collaboration between the mathematics education research and professional teaching communities for the purpose of interpreting and disseminating knowledge about effective mathematics instruction in the elementary and middle school grades. A major goal of the project is to develop and communicate usable knowledge to career teachers about how mathematics in elementary and middle school is learned and how it may be taught more effectively. A parallel goal is the development of a form of communication between researchers and teachers that will support thoughtful and continuing use of research in improving instructional practice.

Two types of products will emerge from this project, specific written materials and a model for the dissemination of research findings that should effect teaching. The written materials will include: Synthesis chapters, written by teams of mathematics educators and cognitive researchers, that will summarize current research knowledge about mathematics topics relevant to grades 3-8; Research translations, written by expert teachers, that will be used as resources for teachers to learn elementary mathematics in a form tied directly to the school curriculum and to problems and opportunities for teaching; Training materials, developed by expert teachers, that will apply the research findings to actual classroom practice, by providing material for reflection, discussion, and teacher planning of instruction.

The model developed by the project will demonstrate a means of bringing research findings to practicing educators via a professional development network supported by a major teachers' union. The channels of communication opened and developed by this project can be effectively used to bring instructional research to the classroom, while at the same time bringing the knowledge and experience of teaching professions to the attention of mathematics researchers and educators.

COLLEGE SCIENCE INSTRUMENTATION

John C. Slimick	USE 8851834
University of Pittsburgh	FY88 $17,328
Bradford, PA	Computer Science

"Data Communications Laboratory"

This project introduces Computer Science students to a laboratory environment where they can master the concepts of data communications.

The equipment in this data communications lab includes four (4) microcomputers that are configured for several network connections: a modem connection and telephone system simulator that offer typical "dial-up" connections between units; a terminal connection that allows simulation of a computer terminal - host interface; an Ethernet configuration that provides high speed networking using coaxial cable.

These equipment configurations, along with some special monitoring equipment and software, allow students to gain hands-on experience in data communications. The experiments that students can perform in such an environment can only be carried on in a dedicated laboratory of the type developed for this project.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

H. Richard Feller	USE 8750050
Richard A. Youchak	FY87 $13,912
University of Pittsburgh	Materials Eng
Johnstown Campus	
Johnstown, PA	

"A Computerized Data Acquisition System for an Undergraduate Engineering Technology Strength of Materials Laboratory"

A Measurements Group 4000 data acquisition system will be added to the strength of materials and advanced structures laboratory. Engineering technology students will be able to rapidly gather data on yield points, moduli of elasticity, and ultimate stresses. In addition, with the computer taking data rapidly, the students will be able to study the statistical variation of the measurements and the effect of changing variables.

COLLEGE SCIENCE INSTRUMENTATION

John A. Beidler	USE 8750630
University of Scranton	FY87 $48,660
Scranton, PA	Computer Science

"An Undergraduate Software Engineering Laboratory"

Under this effort, the principal investigator will construct an undergraduate software engineering laboratory of six Sun 3/52 computer workstations. This laboratory will create an environment in which the students can be taught the software system's specification, design, implementation, and maintenance. The work station will have substantial local computation power, primary and secondary storage and communication support to other devices, including the university's functioning system. Ethernet will be used to link the laboratory to the main university computer as well as other University Networks.

COLLEGE SCIENCE INSTRUMENTATION

Robert B. LaCount	USE 8852592
Waynesburg College	FY88 $17,987
Waynesburg, PA	Chemistry

"Improvement of Infrared Spectroscopy Laboratory Experiences"

The undergraduate Chemistry laboratory program is being improved by the incorporation of new infrared laboratory experiences. An infrared spectrometer has been purchased which is suitable for teaching, routine analysis and senior research applications. Increasingly complex laboratory utilization of the instrument is planned as the students progress from Organic Chemistry to Instrumental Analysis and Physical Chemistry and finally to Senior Research applications. These laboratory experiences are complementing and supplementing the student's present laboratory experiences which are centered around an array of basic instrumentation and a few more sophisticated items. These additional laboratory experiences are better equipping the graduates to meet the challenges of industry and graduate programs.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Jack Waber	USE 8750434
Elise Triano	FY87 $26,600
West Chester Univ of Pennsylvania	Biology
West Chester, PA	

"Instrumentation to Improve Undergraduate Instruction in Physiology and Cellular Biology"

A modern, high technology-oriented physiology laboratory to support the physiology and cell biology courses is being equipped through this award. These courses constitute an integral part of the Biology program and are fundamental to the students' understanding of life processes. Explanations of biological phenomena are increasingly sought at the biochemical level, and are arrived at by employing sophisticated, instrument-oriented techniques such as radioactive labeling of cellular components, spectro-photometric analyses of enzyme activities and metabolic concentrations, and chromatographic procedures for separating complex mixtures into their individual components. A UV/VIS spectrophotometer, a high pressure liquid chromatographic system, and a computer link-up that provides instrument control and data analysis are being added. At least three courses are benefitting directly. In addition, a new instrumentation course is being developed.

In the field of modern molecularly-oriented biology, skill in the use of these techniques and supportive instruments is second only in importance to the students' understanding of the biological concepts for which they are employed.

COLLEGE SCIENCE INSTRUMENTATION

G. Samuel Lightner	USE 8750952
Westminster College	FY87 $9,786
New Wilmington, PA	Physical Sciences

"The Addition of Laser Techniques to Advanced Laboratories in Physics and Chemistry"

Lasers are versatile tools in the physical sciences that are able to accomplish tasks that no other tool can achieve. The advent of inexpensive, easy-to-use and reliable dye lasers makes it possible to introduce a variety of experiments into physical science programs at the undergraduate level. Students in the Departments of Physics and Chemistry will use the lasers and auxiliary detection equipment to perform a variety of experiments including: the measurement of the speed of light in air and liquids, studies of one and two photon fluorescence, the use of Raman scattering to study the structure of molecules, and the detection of subnanogram amounts of toxic aflatoxins from grain samples. The experiments developed in this project will be made available to other schools to extend the impact, and prepare more students for careers in the physical sciences.

COLLEGE SCIENCE INSTRUMENTATION

Percy Warrick, Jr.	USE 8750678
Westminster College	FY87 $5,300
New Wilmington, PA	Chemistry

"Improvement of the Chemistry Advanced Laboratory Program Through the Addition of Differential Scanning Calorimetry"

A modern differential scanning calorimeter is being used by upper level chemistry students at Westminster College to study the thermochemical properties of a variety of materials. The wide range of samples studied include polymers, liquid crystals, metal alloys, and the products from students' organic and inorganic synthesis projects. Students (forty per cent of whom are women) are gaining hands-on experience with this common testing method while investigating the physical nature of phase changes in condensed matter. Each student uses the equipment in at least six different projects, thus gaining a very thorough knowledge of the operation and applications of this important technique. Publication of the laboratory projects will extend the impact of these activities beyond the college.

TEACHER ENHANCEMENT PROGRAM

Sandra K. Webster	TPE 8751223
Westminster College	FY87 $116,714
New Wilmington, PA	Psychology

"High School Psychology Teachers' Science Skills Equipping Project"

Westminster College, New Wilmington, Pennsylvania, will conduct the "High School Psychology Teachers' Science Skills Equipping Project" for forty participants. In each of two summers, a four-week long module will have as its focus research methods applied to cognitive and physiological psychology relevant for the high school psychology curriculum. During three afternoon laboratories each week, participants will act as students in demonstration experiments conducted by the project faculty. Demonstration experiments based on lectures and readings will be designed by the participants, enabling them to approach psychology as a science. Microcomputers will be used to demonstrate basic psychological processes and replicate classic and current experiments in psychology in the high school classroom. During the academic year, the project staff will visit each of the participant's classes, conduct two half-day in-service sessions, and assist in developing a newsletter and psychology fairs. Participants will return to the campus for a weekend at the end of the academic year to share their insights and integrate their experiences into the second summer module for 20 different participants. An extensive and careful evaluation plan has been outlined.

COLLEGE SCIENCE INSTRUMENTATION

John W. Hoopes, Jr. USE 8750339
Widener College FY87 $14,425
Chester, PA Chemical Eng

"On-Line Analysis for an Undergraduate Chemical Engineering Laboratory"

This project will add automatic computer control to a laboratory distillation column with on-line sampling and analysis. A continuous refractometer and gas/liquid chromatograph equipped for direct process analysis, sample-conditioning, and meter/injection systems will complete the feedback loop through an IBM PC to an existing computer. The resulting equipment will provide up-to-date instruction in the operation and control of batch and continuous distillation processes.

COLLEGE SCIENCE INSTRUMENTATION

John E. Molyneux USE 8750611
Timothy J. Singler FY87 $33,700
Widener College Mechanical Eng
Chester, PA

"Open Circuit Low Turbulence Wind Tunnel with Three-Component Sting Balance for an Undergraduate Fluid Dynamics Laboratory"

This project will add a 20" x 28" throat, open cycle wind tunnel and sting balance to the mechanical and civil engineering laboratory. The new tunnel will support a variety of experiments in convective heat transfer that are not supportable with the existing closed cycle tunnel. In addition, the increased size and speed will provide access to high Reynolds number regimes where the characteristic differences between laminar and turbulent boundary layers can be elucidated. Besides strengthening the existing laboratory course, the department plans to introduce a new course in the area of applied fluid dynamics which will be supported by the new machine.

COLLEGE SCIENCE INSTRUMENTATION

Daniel Pindzola USE 8852892
Wilkes College FY88 $56,700
Wilkes-Barre, PA Environmental

"Undergraduate Instruction for Testing Organics in the Environment"

A gas chromatograph-mass spectrometer system with thermal desorption capability has been acquired which permits the quantitative identification of complex organic compounds at low levels in air, water, and soil. This system complements the inorganic, microbiologic, and radiologic environmental monitoring and analysis capabilities of the department. Such equipment is vital to the education of the students in the earth sciences and the environmental sciences and engineering areas, all of whom receive extensive training in most aspects of environmental testing and most of whom secure positions with governmental agencies, private laboratories, environmental groups, or companies directly concerned with environmental testing and assessment. The relative importance of organic compounds in the environment is increasing and students should be provided with the education necessary to identify and assess the significance of these compounds.

The grantee provides funds for this project that are more than an equal match for the NSF award.

PUERTO RICO

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Aurea B. Saez
Science
Francisco Morales High School
Naranjito, RQ

Jose L. Torres Soto
Mathematics
Domingo Aponte Collazo High School
Lares, RQ

1988

Santiago Garcia
Mathematics
Saint John's School
Santurce, RQ

Adele M. Gomez
Science
Saint John's School
Santurce, RQ

COLLEGE SCIENCE INSTRUMENTATION

Deep Aggarwal USE 8853274
Bayamon Technological Univ FY88 $12,300
Bayamon, RQ Mechanical Eng

"Biomedical Instrumentation Laboratory"

This project provides undergraduate students with a hands-on experience in Biomedical Instrumentation. The laboratory that supports the project includes equipment such as: force transducers, EKG machines, sphygmomanometers, magnetic and ultrasonic flow meters, and A/D and D/A converters.

Experiments in this laboratory familiarize students with the underlying physiological principles, the application of biomedical instruments, and the installation, calibration, inspection, preventative maintenance and repair of biomedical equipment.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Freddy R. Medina USE 8750497
Inter American University of FY87 $43.244
Puerto Rico - Metropolitan Campus Biology
Hato Rey, RQ

"Equipment to Upgrade the Undergraduate Biology Curriculum, with Emphasis on Microbiology"

The aim of the project is to give Microbiology, Medical Technology, and Pre-Medical students more "hands on" experience in the undergraduate laboratories, particularly using the kinds of modern equipment adopted by the pharmaceutical, food and medical industries, and by graduate schools.

The new spectrophotometers are being used in the General Microbiology course to construct growth curves of bacteria, in the Parasitology course to perform experiments on enzyme kinetics, and in Immunology to carry out protein concentration determinations. Laminar flows, the inverted microscope, the CO2 incubator and the new centrifuge are being used in Immunology courses to manage Myeloma cells. The miniature and horizontal electrophoresis systems, the transilluminator, shaking incubator and microcentrifuge are used to construct physical maps of plasmids in the Cellular/Molecular Biology course. The Biostat fermenter is used in the Industrial Microbiology course for the continuous culture of various microorganisms of industrial interest. With the equipment provided through this project, students are learning to use electrophoresis, DNA recombination, enzyme kinetics, and ELISA techniques, and are mastering principles of tissue culture and the importance of Myeloma cells.

COLLEGE SCIENCE INSTRUMENTATION

Hector Quintero USE 8750717
Inter American University of FY87 $24.413
Puerto Rico San German Campus Environmental
San German, RQ

"Field and Laboratory Equipment for an Undergraduate Ecology and Environmental Sciences Program in the Caribbean"

The recent acquisition of a core set of ecological instrumentation is making it possible for this Department to expand its upper-level courses as well as to widen the range of the student-oriented research projects it can offer. This development project thus forms an integral part of an ongoing University plan to emphasize the sciences.

The specific impact of this project is on undergraduate instruction in Ecology and the Environmental Sciences. Among the new resources now available to the students are an oceanographic field kit, portable conductivity/salinity meter, dissolved oxygen and biological oxygen demand meter, core sampler and electronic soil testing lab, recording weather station, air quality monitoring devices, and sophisticated laboratory apparati for studying environmental samples brought in from the field for more exacting analysis. This improvement will result in a better prepared graduate of the University who in turn will be better able to perform at the professional level after graduation. The Caribbean area in particular and tropical America in general are in urgent need of trained ecologists to help stem the current catastrophic losses of such natural resources as forest cover, soils and biological diversity, and to help cope with the effects of such losses.

TEACHER ENHANCEMENT PROGRAM

Manuel Gomez-Rodriguez	TPE 8652432
University of Puerto Rico	FY87 $202,542
Central Office	Pre-college Sci/Math
San Juan, RQ	

"Extension of the Puerto Rico Resource Center for Science and Engineering: Comprehensive Summer Training for Elementary and Secondary School Teachers"

The University of Puerto Rico Resource Center for Science and Engineering will conduct four summer workshops for elementary, intermediate, and secondary teachers. Each workshop will provide instruction for forty teachers. The workshops to be conducted are:

I. Teaching Science in the Elementary School
II. Teaching Mathematics in the Elementary School
III. Teaching Science at the Intermediate School Level
IV. Teaching Mathematics for Intermediate and High School Teachers

There will be 8 follow-up sessions on Saturdays during the academic year for each workshop. The workshops will be conducted in two locations simultaneously: Rio Piedras and Mayaguez campuses. Half of the participants will be instructed on each campus during the summer and academic year phase of the program.

The primary goals of this project are to provide teachers with new content, methodology, and a more effective instructional program for their students. Emphasis will be placed on the interdisciplinary nature of bodies of knowledge. Teachers who are participants in this project will be encouraged to share their new knowledge with other teachers in their schools.

COLLEGE SCIENCE INSTRUMENTATION

Sonia L. Vazquez-Garcia	USE 8750795
University of Puerto Rico	FY87 $31,677
Humacao University College	Chemistry
Humacao, RQ	

"Upgrading of the Environmental Chemistry Laboratory through the Implementation of Water and Air Quality Surveillance Stations"

Equipment needed to establish two continuous sampling and monitoring stations; one for air, the other for water surveillance, has been recently acquired by the Chemistry Department at Humacao University College. The availability of these two systems has significantly enhanced the Environmental Chemistry laboratory experiences of students enrolled in both the Associate Degree program in Chemical Technology and the Baccalaureate Degree in Industrial Chemistry curriculum. The air station continuously monitors basic air quality parameters such as carbon monoxide, sulfur dioxide, ozone, organics, heavy metals, and particulates. The water station continuously monitors basic water quality parameters such as temperature, pH, dissolved oxygen, organics, and heavy metals.

CAREER ACCESS OPPORTUNITIES

Manuel Gomez-Rodriguez	USE 8850605
Resource Center for Sci. & Eng.	FY 88 $724,986
Univ of P R Rio Piedras	FY 89 $800,000
San Juan , RQ	FY 90 $800,000
	Minority Center

"Puerto Rico Comprehensive Regional Centers for Minorities"

This project involves a cooperative effort among the members of the Puerto Rico Resource Center for Science and Engineering, a consortium established in 1980 to provide organizational and management structure to coordinate science education activities in Puerto Rico. The membership includes the University of Puerto Rico, Catholic University of Puerto Rico, Interamerican University, Sacred Heart University and the Ana G. Mendez Foundation. It consists of a set of coordinated activities to be implemented throughout Puerto Rico, designed to significantly increase the representation of minorities in careers in science and technology. A special emphasis is placed on impacting those from low-income families which comprise some 65% of the population. The activities are focussed in three areas: precollege (both students and teachers), undergraduate (both students and faculty) and informal science education for the public at large, with responsibilities distributed among the several institutions. For example, at the precollege student level, Saturday Academies and Summer Camps are being held for elementary, junior and senior high students at three campuses of the University of Puerto Rico (Rio Piedras, Mayaguez and Humacao) and at Interamerican University and Catholic University. Summer Research Apprenticeships for senior high students are being conducted at UPR-Rio Piedras, UPR-Humacao and Interamerican University. Activities for the continuing education of precollege teachers are conducted in three modes: intensive four-week summer workshops with academic year follow up for teachers with subject matter and other teaching deficiencies; four-day short courses during the academic year for well-prepared teachers to provide them with knowledge about scientific frontiers in their disciplines together with state-of-the-art educational strategies; a three-phase program to develop a corps of master teachers involving one year of full-time academic study, followed by a one year apprenticeship in a teaching environment, concluding with a one year internship as a master teacher working on curriculum development and instructional improvements in their districts. The Commonwealth Department of Education was fully involved in the planning and development of the precollege component and will play a lead role in institutionalizing the curricular and instructional improvements developed in all of the precollege activities.

A central objective of the Undergraduate Development Component is to more fully involve graduate research faculty in the improvement of undergraduate education. To that end, cooperative efforts between faculty of the Graduate Centers (UPR- Rio Piedras, UPR-Mayaguez and UPR-Medical Sciences) and faculty from the two- and four-year colleges and universities are being undertaken to develop motivational and enrichment experiences for both students and faculty. Summer Research Apprenticeships, Student Seminars, Workshops and Lectures to encourage more undergraduate students to pursue scientific careers; projects for undergraduate faculty including intensive three-day short courses with an emphasis on both subject matter and the application of learning theories to science and mathematics teaching, and longer (2-4 week) workshops focussing on the development of materials for the courses taught by the participants; and improvements in the undergraduate curriculum by joint efforts of the various faculties are among the activities being conducted.

The Science Information to the Community Component involves a multi-pronged approach to convey information about career options in the fields of science and engineering to students and to the public at large. A newsletter (LIAISON), television and radio programs, and communication through local press and news media are utilized in this effort.

This project is an excellent example of a Comprehensive Regional Center for Minorities. It is targeted at a minority population of substantial size (3,500,000), and it is comprehensive in terms of attention to the various educational levels and age groups, in disciplinary coverage, in coordination and cooperation among school systems, colleges and universities and community organizations, and in its focus on nurturing, encouraging and motivating minority students. Significant additional financial support is being contributed to the project by the participating organizations and groups.

YOUNG SCHOLARS

Jose F. Cordova	RCD 8850053
Evelyn Torres Gallardo	FY88 $33,738
University of the Sacred Heart	FY89 $33,738
Santurce, RQ	HS Science

"Young Scholars Program"

The University of the Sacred Heart, Santurce Campus, offers a summer residential program followed by a school year follow-up component for 15 economically disadvantaged students, grades 9 through 12, from the Commonwealth of Puerto Rico public school system.

The project focus is interdisciplinary and stresses the development of basic investigation and research skills. Through lectures on scientific issues and contact with different specialists, participants are presented with a broad spectrum of science and mathematics careers. The project seeks to make a positive contribution to the improvement of the teaching of science and math in the Island's public school system by offering seminars to the teachers of participants.

RHODE ISLAND

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Nancy Nowak
Science
Nathan Bishop Middle School
Providence, RI

Mary J. McNulty
Mathematics
East Greenwich High School
East Greenwich, RI

1988

Loring Coes, III
Mathematics
Rocky Hill School
East Greenwich, RI

Paul M. Mello
Science
Middletown High School
Middletown, RI

COURSE AND CURRICULUM

James H. Voytuk	USE 8814683
American Mathematical Society	FY88 $104,413
Providence, RI	FY89 $ 63,675
	FY90 $ 5,258
	Mathematics

"Proposal for a Newsletter on Collegiate Mathematics Education"

The American Mathematical Society in a cooperative venture with the Mathematical Association of America and the Society of Industrial and Applied Mathematics will establish a collegiate mathematics education newsletter. Its purpose is to stimulate greater communication between research mathematicians, and collegiate mathematics educators.

The newsletter will provide a balance of short, timely items directing readers to sources of further information, and longer, more substantive articles presenting discussion of important issues in collegiate mathematics education.

The newsletter will include articles on mathematics curriculum, innovative teaching methods, funding for collegiate math education, outside classroom activities, profiles of successful math programs, information on conferences, workshops, courses, use of technology, review of international activities, review of information in other publications, and a column for queries.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

COLLEGE SCIENCE INSTRUMENTATION

James G. Magyar	USE 8750620
Rhode Island College	FY87 $19,481
Providence, RI	Chemistry

"Improving Undergraduate Instruction with High Pressure Liquid Chromatography and Atomic Absorption"

The Chemistry Department at Rhode Island College has recently acquired a high pressure liquid chromatograph (HPLC) and a computer interfaced atomic absorption (AA) spectrometer for use in improving undergraduate instruction. With these additions, students are exposed to a wider range of the instruments used in modern research and industrial laboratories and gain experience in using these instruments to increase their problem-solving skills. Analytical skills are being developed which will help prepare students for graduate school or careers in chemistry and other sciences.

COLLEGE SCIENCE INSTRUMENTATION

Rulph Chassaing	USE 8851147
Roger Williams College	FY88 $26,950
Bristol, RI	Electrical Eng

"Digital Signal Processing Laboratory Enhancement"

This project builds on an already existing digital signal processing laboratory at this institution. The extensions to this lab include a software development system, analog interface boards, dynamic signal analyzers and personal computers. Using this equipment, students gain an understanding of the concepts of design trade-offs in digital filtering and spectral analysis.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Daniel D. Von Riesen USE 8750134
Roger Williams College FY87 $6,400
Bristol, RI Multidisciplinary

"Updating the Biology and Chemistry Curricula with a High Performance Liquid Chromatograph"

A more comprehensive and current approach to the teaching of undergraduates in Biology and Chemistry is being made possible with the addition of a High Performance Liquid Chromatography System (HPLC). HPLC is recognized as an instrumental technique of major importance in both biology and chemistry. The project director, who has been actively involved in the development of HPLC instrumentation and software, along with his colleagues, is revising the curriculum in both the biology and chemistry programs so as to provide students with practical, hands-on experience with this fundamental instrumental technique. Seven courses in the two departments are being affected by the project, as well as the independent study and undergraduate research programs. The HPLC system is complementing existing laboratory instrumentation and computer equipment, opening up new learning opportunities.

TEACHER ENHANCEMENT PROGRAM

Donald F. Kirwan TPE 8751216
University of Rhode Island FY87 $444,000
Kingston, RI FY88 $444,079
Physics

"Operation Physics: A National Program for the Improvement of Physics Teaching and Learning in the Upper Elementary and Middle Schools"

This project seeks to develop a model for the improvement of physical science education in grades 4-8 through the development of 15 kits of resources and materials to be used in the training of teams of science educators who will, in turn, use the kits to enhance the physical science background and classroom methodology of teachers in their geographical regions. The project is a cooperative endeavor of three universities in geographically distinct regions of the nation: University of Rhode Island, Louisiana State University, and San Diego State University.

The project involves three distinct activities: 1. the development of the kits of resources and materials by teams of scientists, science educators and teachers; 2. the training of 36 three-member teams (12 from each region) in the use of the kits in their classrooms and the offering of inservice workshops for their peers; and 3. the implementation of the inservice programs with support from both the training staff and regional advisory committees associated with each university site. If the model proves successful, future initiatives will involve the dissemination of the model through the development of more teams in a region or increasing the number of universities involved in the model. The program has the potential to make a significant national impact.

The program is exemplary for the following reasons: it has an eminently qualified staff representing scientists, science educators and exemplary classroom teachers; the focus is on an area and level of science education often cited as needing improvement; the project will utilize personnel and materials from a formerly funded project which enjoys an excellent reputation; it will utilize a "model" which has transferability to other populations and areas of science; the cooperation of several institutions and constituencies provides greater insurance of a significant impact and continuation beyond the period of NSF funding.

COURSE AND CURRICULUM

Edmund A. Lamagna USE 8814017
Diane Johnson FY88 $51,350
University of Rhode Island Mathematics
Kingston, RI

"The Calculus Companion: A Computerized Tutor and Computational Aid"

The main objective of this project is to create a computational environment in which calculus students will use the computer as both a tutoring device and a computational aid. The system will consist of two components: a powerful user interface to a symbolic mathematics package and graphical display routines; and tutorial modules.

In this one year planning grant, a study on how the computer can be best integrated into the calculus curriculum, and a prototypical course module on the topic of integration will be completed. Students will be introduced to important techniques using symbolic computation facilities. The graphical and numerical capabilities will demonstrate several numerical integration techniques. Real world examples from several client disciplines will be used to motivate topics.

University of Rhode Island will provide 40% of the project cost.

SOUTH CAROLINA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Michael H. Farmer
Science
Riverside High School
Greer, SC

Jean U. Phillips
Mathematics
Walhalla High School
Walhalla, SC

1988

Mary F. Babb
Mathematics
Liberty High School
Liberty, SC

Wyatt Y. McDaniel, III
Science
Spartanburg High School
Spartanburg, SC

TEACHER ENHANCEMENT PROGRAM

Juanita S. Scott	TPE 8751254
Benedict College	FY88 $339,244
Columbia, SC	Elem Science

"Middle School Science Development Program"

This project will improve the science education of students in the Richland County schools, South Carolina by enhancing the science background and teaching strategies of 5th and 6th grade teachers. Thirty teachers will participate in a two-year program involving two five-week summer workshops and intensive activity and follow-up during the ensuing academic years. The summer workshops will emphasize science and mathematics content, teaching techniques, and laboratory skills.

Participant teachers will develop and implement "hands-on" science units within their classrooms and provide inservice programs for their peers. The administration of the schools has guaranteed support for both materials acquisition and the remuneration of teachers for conducting inservice programs. The participating teachers will have access to students during the summer to field test the units being developed. The Lawrence Livermore National Laboratory will provide materials and consultant service to the project teachers. A unique aspect of this program is the involvement of parents and sharing the goals and objectives of the program with them.

This proposal is deserving of funding since it focuses on science and mathematics at the upper elementary level, serves an underrepresented population, provides excellent followup activities to the participating teachers, and involves a commitment of the school districts being served.

Pamela E. Mack	SEE 8705056
Mariam R. Levin	FY87 $67,931
Clemson University	History
Clemson, SC	

"A History of the Education of Women in Science"

Since its founding in the mid-nineteenth century, Mt. Holyoke College strongly supported science and contributed to the development of a place for women in science and of a scientific community that reached far beyond the walls of the college. In their study, Drs. Mack and Levin take a broad view of the development of science education in America and the contributions women have made to it. Their work sheds light on the way in which science at Mt. Holyoke was affected by the professionalization of science, changing attitudes in the larger society towards the role of women, and shifting economic and social circumstances in which liberal arts colleges operated.

Specifically, Drs. Mack and Levin are pursuing three lines of inquiry. The first is concerned with the ideology and policies of the school's administrators, trustees, and faculty, the social and economic circumstances within which these ideologies and policies were formulated, and the manner in which they changed over time; the second, with the actual programs, activities, expansions, and reforms that were enacted; and the third with exploring the results of these policies and programs and assessing their possible influence on the scientific community and the interested public for science. Not only will the study contribute to our understanding the historical processes that account for the participation as well as the lack of participation of women in American science in the nineteenth and twentieth centuries, but in doing so, it will also add to our comprehension of the circumstances under which we can expect women to respond to opportunities in science.

This project is funded jointly with the Directorate for Biological, Behavioral, and Social Sciences.

COLLEGE SCIENCE INSTRUMENTATION

Robert J. Dukes, Jr. USE 8616362
College of Charleston FY87 $70,000
Charleston, SC FY88 $50,000
FY89 $50,000
Astronomy

"A Four College Automatic Photoelectric Telescope for Astronomical Training and Research"

Many stars vary in brightness, some regularly, some erratically, some in just a few days, some only over many months. The monitoring of these light variations is important for understanding the structure and evolution of the stars. However, it is so time-consuming that the stars cannot be monitored at major observatories. Telescopes at colleges generally offer the needed time but do not have good enough weather for quality observations. This grant permits four colleges jointly to purchase a suitable telescope and locate it on Mount Hopkins in Arizona, where the climate is good, observing will be directed by a computer, and the telescope will be serviced along with other similar telescopes. The high-quality observations acquired through this arrangement will be analyzed by students and faculty at the College of Charleston and at The Citadel, both in South Carolina, at Villanova University, Pennsylvania, and at the University of Nevada at Las Vegas, Nevada. The investigators will observe single Sun like stars which vary because of starspots and related activity, chemically peculiar stars, long-period Cepheid variable stars, and hot "emission-line" stars. In addition, a system of highly accurate brightness standards will be established, both for ease of measuring variable stars and for later use in connection with the European satellite Hipparcos.

The investigators at the four colleges are faculty who have each established their own astronomical research programs. Undergraduate students will be actively involved in the scientific problems.

This project is funded jointly with the Directorate of Mathematical and Physical Sciences.

COLLEGE SCIENCE INSTRUMENTATION

George W. Shiflet, Jr. USE 8750138
Erskine College and Seminary FY87 $26,854
Due West, SC Biology

"Improved Teaching of Analytical Methods in an Undergraduate Molecular-Cellular Biology Laboratory"

This Biology Department is implementing a curricular change which is designed to provide Biology majors and other Science students with experience in using a modern, quantitative approach in their laboratory studies rather than the more descriptive approach of former years. Most changes involve the Molecular-Cellular Biology course which is being expanded into a two-semester format. There is a parallel upgrading of its laboratories under way.

New, significantly improved laboratory exercises are being made possible through the acquisition of a gas chromatograph, a UV-visible spectrophotometer and a liquid scintillation counter. Further improvements in the program are being made by extending the Department's new analytical capabilities to other courses, and by supplementing such work in the introductory laboratories for Science majors.

COLLEGE SCIENCE INSTRUMENTATION

John D. Batson USE 8750875
Gilles O. Einstein FY87 $29,098
Furman University Psychology
Greenville, SC

"Psychology Microcomputer Laboratory"

In recent years, Furman University has outfitted most of its psychology laboratories with appropriate scientific equipment and as a result, psychology students now receive thorough training in most areas of scientific psychology. They do not, however, have access to powerful microcomputers for data capture and data analysis. The chief objective of this project is to equip a multi-purpose laboratory with sophisticated microcomputers so that the psychology department can better prepare undergraduates for research. Psychology students will get an intensive introduction to microcomputers in the second course in the major and will build upon this foundation in upper-level courses.

The computers will be used in three ways. First, and most importantly, students in the course "Experimental and Statistical Methods" will learn to use computers for collecting and analyzing data from experiments they conduct in the course. Second, advanced majors will use the computers for independent research projects that cover a variety of experimental contexts. Finally, a large number of students will utilize the proposed laboratory to conduct computerized exercises (simulations, classic experimental protocols) that demonstrate phenomena that are discussed in many of the upper-level courses and to analyze data that are collected in these courses.

This project will permit the psychology department to complete its goal of equipping the experimental laboratory courses with high quality scientific instruments. The psychology program will be greatly enhanced, particularly for majors and those students who wish to pursue graduate work in research programs.

COLLEGE SCIENCE INSTRUMENTATION

Gilbert W. Fairbanks USE 8853268
John D. Batson FY88 $41,255
Furman University Biology
Greenville, SC

"Instrumentation to Support Interdisciplinary Undergraduate Studies in Neurobiology"

With help from the instruments obtained through this project, the Biology and Psychology Departments are increasing their interdisciplinary approach to neurobiological studies. The two departments already share labs and animal room facilities and cross-fertilize one another's laboratory exercises in Physiological Psychology and Histology. In the latter case, lesioned rat brains are microscopically examined in the Histology lab. The present project is fostering the further development of this type of cooperation.

With a new Biology faculty member who is acquainted with fluorescent microscopy, studies of brain neurotransmitters are being incorporated into several courses. With new computer-interfaced instrumentation, the Psychology Department is able to improve undergraduates' laboratory work in Electrophysiology. Through the sharing of this equipment, techniques perfected in the Psychology Department have become available to students in Physiology courses. Additional instruments enable the Psychology Department to include in its laboratory program some EEG and biofeedback studies, while enabling the Biology Department to update the performance level and reliability of its physiological monitoring equipment. The requested equipment also enhances undergraduate research projects already boosted by a highly effective DANA Foundation program which financially supports undergraduates doing summer research.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Noel Kane-Maguire USE 8750209
Furman University FY87 $50,000
Greenville, SC Chemistry

"Introduction of High-Field Nuclear Magnetic Resonance Spectroscopy into the Undergraduate Curriculum"

A high-field nuclear magnetic resonance (NMR) spectrometer is a recent acquisition by the Chemistry Department of Furman University. This instrument, used for undergraduate instruction, provides experience with the most important advances in NMR of the past decade: methods for obtaining detailed structural information (high-field NMR); detailed procedures for elaborating that information (2-D NMR); and techniques for assessing the motion of molecules (relaxation measurements). Development of skills in these areas is extremely important in contemporary chemistry, and they provide the basis for NMR imaging, the technique expected to complement medical X-rays. This instrument is being used by students through the entire range of the curriculum from the instrumental analytical course through its use in undergraduate research.

COLLEGE SCIENCE INSTRUMENTATION

Hayden S. Porter, Jr. USE 8851835
Furman University FY88 $23,208
Greenville, SC Computer Science

"Adding Fourth Generation Language and Real-time Concepts to an Introductory Computer Science Course"

This project introduces bold changes to the introductory- level Computer Science course at this institution, a course patterned on the recommendations of the ACM Curriculum '78 guidelines. Unlike traditional courses that concentrate almost entirely on the teaching of a third generation programming language, the new course first has the students solve complex problems using fourth-generation application specific languages. They then progress through database and graphics concepts utilizing a real-time data acquisition laboratory experience. The course includes the teaching of a third generation programming language but comprehensive user-friendly tools drastically shorten the time needed for students to achieve a high level of programming proficiency.

The laboratory environment that supports this project includes: MAC II workstations, connected by AppleTalk local area network software and hardware, a dedicated MAC II fileserver, an Imagewriter LQ printer, and, instrument interfaces to connect the configuration to digitizers, A/D-D/A converters, graphic printers and plotters.

Students in this course achieve a broader understanding of the capabilities of computers and gain valuable experience in exercising these insights on problems of a more useful and realistic scale than is possible in most introductory courses.

This award is being matched by an equal sum from the grantee.

COURSE AND CURRICULUM

Daniel C. Sloughter USE 8813781
Robert D. Fray FY88 $22,746
Furman University Mathematics
Greenville, SC

"Restructuring One Variable Calculus within a Modeling and Computer Oriented Environment"

Mathematicians at Furman University will develop and pilot test an experimental one variable calculus course which builds and analyzes realistic models of dynamic processes, including 'chaos'.

The course restructuring will start with sequences of real numbers, difference equations and end with differential equations.

Global and qualitative behavior will be stressed by use of the computer. There will be modeling with symbol manipulation, discrete mathematics and numerical mathematical packages.

The grantee is providing almost 60% of the cost of the project with purchase of equipment and in-kind services.

This project is co-funded with the NSF Directorate for Mathematical and Physical Sciences.

COLLEGE SCIENCE INSTRUMENTATION

Laura K. Thompson USE 8851898
Furman University FY88 $22,604
Greenville, SC Biology

"Equipment for a Modern Undergraduate Molecular Genetics Laboratory"

This department is using the present award to procure the equipment needed for teaching of modern nucleic acid research, providing students an opportunity to explore such modern research techniques as recombinant DNA technology and protein analysis. DNA electrophoresis and protein gel electrophoresis units along with such supportive equipment needed in work with recombinant DNA as a micro- centrifuge, micropipetters, a UV transilluminator, speed vac, vacuum oven, shaker incubator, sonicator, and cold cabinet are being used by students in a new course, Molecular Genetics, as well as in two already established core courses.

Students learn protein chemistry, DNA structure, RNA expression, and other protocols used in recombinant DNA technology. In a five-year period about 250 undergraduates involved in an average of three to four courses per student will have extensive hands-on experience with this equipment.

This project is one result of the university's positive steps toward providing its students with classes in the rapidly expanding field of genetic engineering and recombinant DNA technology. A biology faculty member with expertise in these fields, hired in 1987, is designing the new Molecular Genetics course.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Edward Stampf, Jr. USE 8851562
Lander College FY88 $25,758
Greenwood, SC Chemistry

"FTIR for Enhanced Undergraduate Chemistry Instruction "

A Fourier Transform Infrared (FTIR) Spectrometer has been acquired and is being used in Introductory Organic Chemistry, Advanced Organic Chemistry, Inorganic Chemistry, Chemical Instrumentation, Physical Chemistry and Chemistry research. The FTIR is being used to supplement existing laboratory techniques for elucidating structure, providing alternate methods of quantitative analysis and allowing for more sophisticated experimentation in upper division courses. In addition, Fourier transform methodology is being incorporated into the laboratory for the first time. Data manipulation and spectral search capabilities of the FTIR make it a powerful learning tool for students. Experience with the FTIR is assisting the students in remaining competitive in the job market where FTIR is fast becoming the norm.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Hamed Javad USE 8852456
Midlands Technical College FY88 $31,540
Columbia, SC Electrical Eng

"Integrated Process Control Laboratory"

This project allows students in a two-year technology program to study Process Control in a state-of-the-art training laboratory. This laboratory, equipped with programmable logic controllers, permits students to apply their understanding of Classical Control Theory within a totally integrated technological setting. These students are being prepared to function in industrial environments that are increasingly moving toward automated manufacturing processes.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Marion T. Gaines, IV	USE 8750514
Presbyterian College	FY87 $7,741
Clinton, SC	Psychology

"A Computer-Managed Laboratory for Physiological and Experimental Psychology"

The purpose of the project is to develop a computer-managed laboratory for physiological and experimental psychology. One such system, developed in the psychology department, permits the precise programming of experimental events, the collection of data, and the analysis and display of results. It has been used to measure reaction times, GSR, EMG, heart rate, temperature and EEG. Because of increasing demands for time with this system, the psychology department plans to construct three more, one with enhanced capabilities for state-of-the-art student research. This enhanced model will be interfaced with a three-field projection tachistoscope and four biopotential preamplifiers for elaborate control of visual events and rapid tracking of evoked EEG activity across the cortex (among other uses). The tachistoscope and amplifiers can be divided to provide for simpler but simultaneous data collection using all the computers. This would be ideal for lab exercises in physiological and experimental psychology. The versatility and precision of this lab system should provide varied possibilities for directed student research, laboratory work in the methodology course, and classroom demonstrations in introductory psychology.

INFORMAL SCIENCE EDUCATION

Charles S. Morris	MDR 8751860
Kenneth Mandel	FY88 $179,999
Daniel B. Polin	FY89 $180,000
Michael Pack	Civil Eng
South Carolina Educational Television	
Columbia, SC	

"GREAT PROJECTS in Engineering -- Its History, Present Practice, and Future Prospects"

GREAT PROJECTS will be a six-part series of television programs on large-scale engineering in society, co-produced by SCETV and Manifold Productions for national PBS distribution. The six one-hour programs will examine civil engineering projects from the perspectives of the historical role of engineering, the risks and benefits of new projects, and engineering's role in meeting humanity's future needs.

This series will be one of the few programs on public television which has examined civil engineering from a wide perspective, and will be the first to explicitly look at the benefits, costs and societal consequences of investment in large-scale engineering and infrastructure projects. In addition to informing and educating the public about the field of civil engineering, it will serve to illustrate engineering professions and to provide realistic role models for student career choices.

GREAT PROJECTS will be sponsored by the National Academy of Engineering, which will convene a National Advisory Committee to insure balance, accuracy and objectivity in the series' content. Substantial use will be made of professional, academic, and governmental advisors and experts in preparation of its content. Support for the project will be raised from corporations, foundations and professional societies; the National Science Foundation is providing approximately 10% of the $3.8 million project total.

COLLEGE SCIENCE INSTRUMENTATION

Floyd L. Wilcox, Sr.	USE 8853149
Tri-County Technical College	FY88 $98,759
Pendleton, SC	Electrical Eng

"Automated Student Laboratory for Electronic Engineering Technology Curriculum"

This project enhances Electronics education at this community college. Students are able to use this institution's automated circuits laboratory stations to: calculate and set circuit parameters for their circuit designs, analyze circuit performance using the computer simulator, and test the hardware version of their design for its real behavior. The equipment that supports this lab, primarily from Hewlett Packard, includes: Measurement Automation Systems, display interfaces and resource managers, graphics printers, function generators, digital multimeters, dual channel digital oscilloscopes, multimeters, power supplies and programmable scanners.

This award is being matched by an equal sum from the grantee.

TEACHER ENHANCEMENT PROGRAM

William A. Pirkle	TPE 8652415
Richard J. Pryor	FY87 $149,501
Gwen Johnson	FY88 $357,189
University of South Carolina Aiken	Biology
Aiken, SC	

"USCA Science Education Center"

This grant will help establish the Central Savannah River Area Science Education Center as a permanent facility. The Center represents a cooperative effort between the University of South Carolina at Aiken, local school districts, and the private sector. It works within the established school system to enrich the teacher's understanding of science, technology and the scientific thought process.

The NSF award to the University will help accomplish the goals through a multifaceted program which includes institutes, workshops, and mini-courses held during the summer and the academic year.

In addition to providing learning opportunities for teachers and students, the center is in the process of acquiring teaching materials and equipment for educators to use on a check-out basis. Through the partnership, a reference catalog of resources (guest lectures, advisors, consultants, field-trip sites) from the private sector is presently being compiled and prepared for distribution.

Through the collaborative effort of the University, the school district, and the private sector, an amount equal to 97% of the NSF award will be contributed to this project.

COLLEGE SCIENCE INSTRUMENTATION

Susan M. Libes	USE 8852385
Univ of South Carolina Conway	FY88 $20,767
Conway, SC	Biology

"Undergraduate Equipment for Applying Qualitative and Quantitative Analysis to Environmental Monitoring"

This Marine Science Department recently developed an area of emphasis in Marine Analytical Technology (MAT), the aim of which is to produce environmental technicians. Particular emphasis has been given to acquisition of organizational and analytical skills needed to monitor environmental quality and to assess the impacts of pollutants. This grant provides funds to purchase equipment needed to measure a variety of federally-recognized Priority One Pollutants using methods approved by the Environmental Protection Agency. The equipment required is a gas chromatograph for pesticide, PCB and PAH analysis, a graphite furnace for heavy metal analysis, and a silica cell for petroleum-hydrocarbon fingerprinting. The latter two pieces of equipment are accessories to equipment already on hand, i.e. an atomic absorption spectrophotometer and an infrared spectrophotometer, respectively. The machines will be used in laboratory courses required in the MAT program, as well as in elective courses and in undergraduate independent research projects.

The increasing amounts of environmental management being conducted in this country and worldwide assure a large ongoing demand for well trained environmental technicians. Thus this project is significant in that it supports a program expressly designed to teach students highly marketable science/technology-based skills that can be acquired during the undergraduate years.

The grantee institution is matching the NSF award with a slightly greater sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Daniel J. Antion	TPE 8470161
University of South Carolina	FY85 $475,000
Columbia, SC	FY86 $432,000
	FY87 $350,000
	FY88 $ 7,112
	Mathematics

"South Carolina Cooperative Plan for the Professional Development of Science and Mathematics Teachers in Grades 7-12"

This project is a three-year comprehensive inservice teacher education program. The program is exemplary in the extent of the cooperation between the University of South Carolina, The Citadel, Clemson University, The College of Charleston and state and local officials.

The primary activity of the project is the offering of twenty-seven summer workshops covering nine different subject areas. The proposed schedule of offerings is a follows:

- Biology; grades 9-12; 6 weeks during summer; 25 participants; years 2,3,4; 75 total participants; Clemson University.
- Chemistry; grades 9-12; 4 weeks during summer; 20 participants; years 2,3; 60 total participants; University of SC.
- Computer Science; grades 9-12; 6 weeks during summer; 25 participants; years 2,3,4; 75 total participants; Univ of SC and Clemson Univ.
- Earth Science; grades 9-12; 6 weeks during summer; 25 participants; years 1,2,3; 75 total participants; Univ of SC.
- Life Science; grade 7-9; 6 weeks during summer; 25 participants; years 1,2,3; 75 total participants; Clemson University.
- Mathematics; grades 7-9; 6 weeks during summer; 25 participants; year 1,2,3; 75 total participants; Univ of SC.
- Physical Sciences; grades 7-9; 6 weeks during summer; 25 participants; years 1,2,3; 75 total participants; College of Charleston.
- Physics; grades 9-12; 6 weeks during summer; 20 participants; years 2,3,4; 60 total participants; College of Charleston.

In additional to the workshop, follow-up activities are offered during the academic year.

The project also includes a materials development and dissemination component, the employment of pre-college master teachers in addition to university personnel, and a diagnostic services and career development program. This latter program is designed to provide for professional and confidential assessment of teachers, to provide career planning assistance, and to provide follow-through support. A particular focus of these services will be to assist each teacher to realize more fully his or her continuing need for further professional training and development.

The FY88 Supplemental Grant will enable The University of South Carolina to disseminate information about their project to regional and national audiences at several professional meetings.

The project has supplied important information concerning the development of successful consortia, the establishment of a diagnostic service and career development program, the planning of state-wide enhancement programs, and commitments for state assistance in the support of programs.

The Principal Investigator will present papers or lead symposia discussing successful NSF projects at the following: Regional and National Science Teacher Association Meetings, Regional and National meetings of the American Chemical Society, and the 10th Biennial Convention on Chemical Education.

SOUTH DAKOTA

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Janet Palmer
Science
Warner School District #6-5
Warner, SD

Marla Walz
Mathematics
Pierre Junior High School
Pierre, SD

1988

Vicki Fredrickson
Mathematics
Simmons Junior High School
Aberdeen, SD

Robert W. Waddell
Science
Belle Fourche High School
Belle Fourche, SD

COLLEGE SCIENCE INSTRUMENTATION

Leland G. Johnson USE 8851188
Augustana College FY88 $19,400
Sioux Falls, SD Biology

"Oxygen and Carbon Dioxide Analysis Systems to Enhance Laboratory Exercises in Whole Organism Biology"

The aim of this project is to provide undergraduates new experiences in applying state-of-the-art, computer-interfaced instruments to the study of whole organisms. It permits them to implement metabolic studies at several levels in the Biology curriculum through the acquisition and utilization of two Ametek S- 3A/II oxygen analyzers, the upgrade of the Li-Cor CO2 analyzer to the standard of Li-Cor 6250, and acquisition of appropriate computer and interfacing equipment.

The Ametek oxygen analyzers are being applied to laboratory exercises on metabolism in freshman Biology and in three upper division courses. Several of these laboratory exercises examine temperature effects on biological processes. Both instruments and the computer-interfacing capabilities also enrich independent study and research participation programs which are viewed as essential for a strong department. The project is significant because it enhances quantitative and experimental experiences at the organismic level in this department, at a time when improvements recently have been made in instrumentation and methodology for ecological studies and for cellular and biotechnological studies. Students at several levels of educational development now have access to quality systems for studies of organismic gas exchange in highly experimental settings in which instruments are computer controlled and data are reduced and analyzed on-line.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Karel V. Lugt	USE 8851445
Augustana College	FY88 $13,630
Sioux Falls, SD	Physics

"Laboratory Station for the Synthesis and Analysis of Sound in Undergraduate Laboratories"

This project allows purchase of an audio fast Fourier analysis system, a digital sampling synthesizer, and a Macintosh II microcomputer system with associated software. This equipment will be used to improve instruction in Physics courses for majors and non-majors by allowing students to carry out experiments in the synthesis and analysis of sound. Physics students will use the equipment in an advanced laboratory course, while non-majors (including special education and speech therapy students) will use the equipment in Introductory Physics laboratories, and in a special course on the analysis and synthesis of sound.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Larry L. Tieszen	USE 8851442
Augustana College	FY88 $39,215
Sioux Falls, SD	Biology

"Isotope Ratio Mass Spectrometry in the Undergraduate Biology Curriculum"

The goal of this project is to upgrade the department's Isotope Ratio Mass Spectrometer (IRMS) because this instrument has become a central instructional tool in several advanced courses and is now essential for the independent study/research participation programs mentored by three faculty members. The instrument allows students to study ecological, physiological and biochemical phenomena with a modern approach utilizing natural abundances of the stable isotopes of carbon (13C) and nitrogen (15N) as quantitative tracers. The upgrade automates sample analyses and facilitates throughput by students, adds a third detector to facilitate isotopic corrections, allows nitrogen analyses to be undertaken readily, and utilizes a computer-controlled analytical system which transmits data to a departmental network for reduction, statistical analyses, and presentation. The instrument is being supported by an IRMS technician who facilitates student training and use. The upgrade is significant because it extends the instrument into the hands of more students in advanced courses and enhances student-mentor opportunities.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Duane E. Weisshaar	USE 8851195
Augustana College	FY88 $15,765
Sioux Falls, SD	Chemistry

"A Chromatography Module for the Chemistry Curriculum"

The new Chromatography curriculum is exposing all of the Chemistry majors and many additional students to GC employing temperature programming, capillary columns, TCD, FID, and GC/MS; and to HPLC utilizing normal phase, reverse phase, ion and GPC columns; isocratic and gradient elution; and UV, fluorescence, conductivity, and refractive index detection. These students are gaining experience in the use of computers for data collection and analysis. They are increasing their ability to use computers to prepare formal scientific reports incorporating the analyzed data. In addition to the 2 HPLC's (one a gradient system), a GC/MS, and several student model GC's previously available in the department, this project has added a dual column, microprocessor controlled gas chromatograph with temperature programming and capillary column capability, a refractive index detector for HPLC, and a PC based chromatography data station. Thus, the experiments in seven courses and student-faculty research is extending the students' understanding and appreciation of chromatography as a tool for a wide variety of applications as well as giving them experience using computers and computer controlled instrumentation for Chemistry laboratory applications.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Oscar H. Will, III USE 8750043
Larry L. Tieszen FY87 $18,417
Augustana College Biology
Sioux Falls, SD

"Equipment to Enhance an Undergraduate Biotechnology Curriculum"

New thrusts in Biotechnology are being provided in the curriculum at the freshman, sophomore and advanced levels. Related laboratory experiences include work in modeling, DNA manipulation, fermentation, and tissue culture using agarose gel electrophoresis and electro-blotting. New equipment supporting these advances include a hood, a freeze dryer and a computer-based data acquisition system. Three tissue culture, three DNA manipulation, a stable isotope plant selection exercise, and two computer modeling lab sessions are being added to existing courses.

A new lab oriented-course called Biotechnology also is being developed. Its major components involve recombinant DNA methods, fermentation, bioproduction and bioconversion, eukaryotic tissue culture and differentiation, and simulation modeling. Enhanced educational opportunities in experimental and quantitative Biotechnology are being provided, and a regional need for formal education in Biotechnology is being met.

TENNESSEE

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Diane M. Jernigan
Science
Trezevant Vocational Tech Center
Memphis, TN

Oma W. McNabb
Mathematics
Riverdale High School
Murfreesboro, TN

1988

Deanna M. Mauldin
Mathematics
Liberty Bell Junior High School
Johnson City, TN

Jean T. Boone
Science
M L King Jr Magnet H S
Nashville, TN

COLLEGE SCIENCE INSTRUMENTATION

Harvey F. Blanck USE 8750101
Austin Peay State University FY87 $18,608
Clarksville, TN Chemistry

"Integration of a Fourier Transform Infrared Spectrometer into the Chemistry Curriculum"

The Chemistry Department at Austin Peay State University has recently acquired a microprocessor-interfaced Fourier Transform Infrared (FTIR) Spectrometer which is being used to enhance undergraduate instruction by integrating FTIR applications into several courses in the curriculum. Specifically, the system is used in instrumental methods of analysis and organic chemistry courses for compound identification and in physical chemistry to study the properties of compounds.

TEACHER ENHANCEMENT PROGRAM

George N. Bratton TPE 8751695
Thomas R. Hamel FY88 $105,462
Ernest L. Woodward Mathematics
Austin Peay State University
Clarksville, TN

"Elementary Mathematics Instructional Improvement Project"

This project offers a month-long summer institute for 30 well- prepared elementary school teachers from Tennessee which will be followed, during the academic year, with activities at the participants' school districts. The focus is on three main areas: geometry, problem-solving, and instructional computing. These are interconnected in the project by involving problem-solving activities in the study of the geometry topics as well as incorporating computer investigations into the geometry and problem-solving activities. The graphic capability of the computer language LOGO also serves as the vehicle to develop an interplay between the geometry topics and the problem-solving situations. The 30 participants are selected by the school districts that are committed to the project, and the plan is to implement the project activities into the programs at the participants' districts to continue the work of the project and extend the knowledge and techniques developed to other teachers in the districts.

COLLEGE SCIENCE INSTRUMENTATION

Diane L. Simmons	USE 8852900
Austin Peay State University	FY88 $11,423
Clarksville, TN	Chemistry

"Integration of an Atomic Absorption Spectrophotometer into the Chemistry Curriculum"

A state-of-the-art Atomic Absorption (AA) Sspectrophotometer is being incorporated into several Chemistry courses. It is being used in an Instrumental Analysis course, an Inorganic course, a Physical Chemistry course, and for student research. Students are getting hands-on experience in the operation of the AA, which employs micro- processor controlled operation and a self-contained microcomputer. Data is displayed on a CRT and can be printed or plotted if desired. Students from local high schools also spend a day at the university working with the instruments and observing. One of the projects of interest to the students is the investigation of the concentration of metals in the groundwater of Humphreys County, Tennessee.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

W. David Driskill	USE 8750561
Belmont College	FY87 $5,500
Nashville, TN	Physics

"Upgrading of an Undergraduate Modern Physics Laboratory"

Belmont College will improve and enhance the laboratory instruction provided students in a modern physics course. The students enrolled in this course are physics majors and minors, pre-engineering majors, chemistry majors, and mathematics majors. The project will increase the number and level of sophistication of the experiments conducted in this course. Students will be given greater opportunity for "hands-on" experiences with the concepts and phenomena of modern physics.

Equipment items to be purchased include an alpha/beta spectrometer, an X-ray spectrometer, and an electron spin resonance probe. Experiments that explore alpha particle energy spectra, beta particle energies, ESR phenomena, and Zeeman effect studies will be added to the course. Students will have a better understanding and appreciation of the relationship of theory and experiment. The result will be a more balanced presentation of the concepts and phenomena of modern physics.

COLLEGE SCIENCE INSTRUMENTATION

Wayne Jones	USE 8853340
Chattanooga State Tech	FY88 $88,200
Chattanooga, TN	Mechanical Eng

"Computer Integrated Manufacturing"

This project supports a hands-on experience for students in this institution's program in Computer Integrated Manufacturing (CIM). Using the equipment in the CIM lab, students learn how to apply existing state-of-the-art technology to a real life manufacturing environment. The project builds on an already existing automated manufacturing cell. Two computers and several work stations are linked to the cell. Students experiment with all processes in the manufacturing cycle - production forecasting through design, manufacturing and shipping. The unique aspect of this facility is that students interact with a common data base to coordinate all production processes using real machine tools.

This award is being matched by an greater than equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Steven S. Crider	USE 8853322
Christian Brothers College	FY88 $19,000
Memphis, TN	Civil Eng

"Civil Engineering Water Resources Laboratory"

This project strengthens students' understanding of the fundamental principles of Water Resources Engineering through the use of a new laboratory. The laboratory concentrates on water quantity rather than quality, giving students a physical understanding of the conservation of mass, momentum and energy principles. The equipment supporting this project includes: hydraulics bench, pressure gage, orifices, open channel flume, pipe networks, soil permeability meter and accessories.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Donald Glaser	USE 8750504
Christian Brothers College	FY87 $50,000
Memphis, TN	Electrical Eng

"Undergraduate Electrical Engineering Student Development Workstations"

A modern microcomputer laboratory consisting of nine stations will be set up to complement courses in microcomputers and microprocessor interfacing. Each workstation will consist of an IBM PC/AT and a Motorola 68000 emulator system. Students will be taught the whole concept of microcomputers and how they interact with real world devices, not just programming in either a high level or assembly language. The system as envisioned will also allow relatively inexpensive updating as more modern chips become available.

TEACHER ENHANCEMENT PROGRAM

Alfred Wohlpart	TPE 8550505
Wayne Stevenson	FY86 $158,900
Department of Energy	FY87 $141,000
Oak Ridge Operation	FY88 $ 90,000
Oak Ridge, TN	HS Math/Sci

"STRIVE: Science Teachers Research Involvement for Vital Education"

This project proposes a diversified plan to promote the professional development of teachers and to raise the quality of teaching. Twenty science and mathematics teachers from Tennessee junior and senior high schools will participate each year. The project will coordinate with and complement the State of Tennessee's Career Ladder Program.

Participating teachers will engage in full-time energy-related research for eight weeks during the summer. The summer program will include weekly workshop sessions designed to provide the opportunity to develop resource materials and to explore creative ways to enrich the teaching of precollege science and mathematics.

To reinforce and encourage implementation of the most important aspects of the summer research participation workshop programs, the following complementary academic-year activities are planned:

Academic-Year Forums. Six will be held during the academic year. A forum will involve teachers who participate in the summer program, other science and mathematics teachers, and students.

Science Mentor Visitations Programs. The research scientists who supervise the summer research participants will make visits and give presentations, will assist students and teachers in laboratory experiments and research projects, and will provide other help in their areas of expertise.

Scientist Lectures Programs. Scientists from U.S. Department of Energy Laboratories in Oak Ridge and from other facilities will visit area schools to present lectures and laboratory demonstrations.

Teacher Bootstrap Program. Teachers who participate in the summer program will serve as "in-residence resource teachers" and will be encouraged to make presentations and to show their knowledge and experience. Staff development credit toward career ladder promotions or academic credit may be arranged for this activity.

TEACHER ENHANCEMENT PROGRAM

Katie Dunn	TPE 8554433
East Tennessee State University	FY86 $403,642
Johnson City, TN	FY88 $279,658
	FY89 $150,000
	Mathematics

"MATHCAPS: Mathematics Consortium for Applications and Problem Solving Project"

This project will provide enhancement and professional development experiences for 150 exemplary mathematics teachers and up to 450 of their peers from the eastern Tennessee area. The overall goals of the multi-year project involve the updating and deepening of the participants' mathematical backgrounds and teaching methods, the networking of the 540 participants, the conduct of frequent in-service helping and sharing sessions by the participants in their schools, the dissemination of the project materials and results, and the completion of a carefully planned documentation, assessment, and evaluation effort. The MATHCAPS consortium of teachers and administrators of area schools, faculty and administrators of colleges and universities, state-level educators and officials, scientists from a federal research laboratory, and leaders from business and industry provides the strategic approach and financial base for institutionalizing the project.

In the first phase, 30 middle school leader teachers will participate in an 8-week summer workshop, academic year meetings, and a 5-week summer workshop. The 150 peers will visit each summer workshop in order to build a strong team effort. In the second summer, 30 elementary leader teachers will begin their project involvement. The mathematical education goals, contents, and methods of the project have been conceptualized through advice from teachers, supervisors, mathematics teacher educators and researchers, and evaluation experts. Selection procedures are thorough, involving specific commitments of time and effort by leader teachers, peer teachers, and their principals. Treatments of major mathematical curricular areas will be provided through Visiting Scholars selected for their expertise from research and teaching experience. Frequent and meaningful academic year follow-up will be completed by project staff and all teachers. Significant materials will be produced, tested, and refined by the staff and the teachers, including video-tape protocols of outstanding teaching and in-service modules for use by other leader-peer teams of teachers. All aspects of the model will be documented and an external evaluation will be conducted.

TEACHER ENHANCEMENT PROGRAM

James E. Robinson TPE 8751258
Le Moyne-Owen College FY87 $108,304
Memphis, TN FY88 $ 99,992
Mathematics

"Project Teacher Enrichment and Reinforcement in Mathematics (TERM)"

This two-year project addresses the mathematical and computer science needs of 40 Memphis middle and high school teachers of minority students by providing an intense summer workshop with academic year follow-up. Le Moyne-Owen, a traditionally black college, will run this project with the cooperation of the Memphis Urban Mathematics Collaborative (funded by the Ford Foundation).

The objectives include strengthening mathematics backgrounds, improving teaching skills, fostering cooperation between teachers and college faculty, and introducing teachers to the microcomputer and programming.

During the five-week workshop the teachers will study logic, sets, function optimization, induction and combinatorics, probability, matrices, linear programming, discrete mathematics, and computers. The teaching strategies will include problem solving, development of mathematical models, and teacher presentations. Teachers will earn three credits for the course work. The academic-year follow-up will include two mini-conferences for all participants and on-site visits by the staff to the teachers' classes.

COLLEGE SCIENCE INSTRUMENTATION

Jerry E. Waters USE 8750121
Maryville College FY87 $9,487
Maryville, TN Psychology

"Introduction of Psychobiology into the Curriculum"

The discipline of psychobiology is being introduced into an interdepartmental advanced level research seminar for psychology and biology majors. Improved physiological measurement experiments are being added to both the laboratory and the research components of the undergraduate psychology and biology curricula. The acquisition of an eight-channel Narcotrace-80 physiograph with the necessary accessories is allowing measurements in sleep physiology and learning, classical conditioning, and biofeedback, as well as heart and muscle physiology. Detailed and accurate physiological measurements are being facilitated with the introduction of physiobiology into the curriculum.

COLLEGE SCIENCE INSTRUMENTATION

Kevin M. Ogle USE 8851358
Rhodes College FY88 $22,697
Memphis, TN Chemistry

"Surface Reactions, Material Science, and Computer Controlled Instrumentation with Fourier Transform Infrared Spectroscopy in Undergraduate Instrumental Analysis"

Experiments involving the analytical chemistry of materials (with special emphasis on polymers) and surfaces are being introduced in the senior Instrumental Analysis course using Fourier transform infrared spectroscopy. Diffuse reflectance and photoacoustic detection is being used to illustrate the analysis of opaque samples such as polymer fibers, coal, soil, and minerals. The analytical characterization of surface species on polymer or metal surfaces is being illustrated using specular reflectance and attenuated total reflectance. Such experiments are illustrating the power of modern spectroscopic techniques as applied to complex, heterogeneous systems and are exposing the students to problems of a very practical "real world" nature.

The basics of computer controlled instrumentation is also being stressed. The experiments are using spectral substraction and normalization software routines, as well as the spectral libraries for the analysis of polymer mixtures.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Irving T. Glover	USE 8852155
Roane State Community College	FY88 $5,332
Harriman, TN	Chemistry

"Scanning Spectrophotometry in Organic Chemistry"

Students in Organic Chemistry and in special problems courses in scientific research are doing experiments in the ultraviolet and visible region of the spectrum. Students are gaining experience with their own spectra of organic compounds for spectra structure correlations and learning to operate a modern, programmable, computer- directed spectrophotometer equivalent to those used in industry and national laboratories. The students are doing experiments such as the measurement of the spectra of aniline, the anilinium cation, and nitrobenzene. They are then considering the displacement and enhancement of absorption bands in the spectrum due to the structural substitution of the amino group on the aromatic ring, the disappearance of the shift and enhancement when the amino group is converted to the anilinium cation, and the appearance of additional bands when the structural change involves substitution of a nitro group on the benzene ring.

The grantee is matching the award from non-Federal sources.

YOUNG SCHOLARS

Marc L. Burnett	RCD 8850118
Tennessee Technological Univ	FY88 $15,380
Cookeville, TN	FY89 $15,380
	Engineering

"Introduction to Engineering and Computers"

Forty students who have completed the junior year in secondary schools having limited facilities or instruction, primarily from the Southern Appalachian region, participate in an enrichment program centered on engineering. The program consists of lectures in the Introduction to Engineering series, engineering design, energy and environmental engineering. The participants develop a proficiency in Fortran IV programming on the main University computer system and on microcomputers. They work in design teams to develop an engineering design of a device or system. Field trips are made to the Arnold Engineering Development Center (U.S. Air Force), to a TVA power plant, and to a local industry.

COLLEGE SCIENCE INSTRUMENTATION

Robert L. McNeely	USE 8853033
Univ of Tennessee Chattanooga	FY88 $8,140
Chattanooga, TN	Chemistry

"Electrochemical Instrumentation for Undergraduate Instruction"

A comprehensive state-of-the-art electrochemical instrument is being acquired to allow hands-on experience in teaching young student scientists basic electroanalytical chemical instrumental methods of analysis such as polarography, pulse polarography, stripping voltammetry, and cyclic voltammetry. The system includes a control unit, a static mercury drop electrode unit and a digital plotter. The instrument is being used each year by 80 students in five undergraduate courses which serve Chemistry majors. Direct experience with up-to-date scientific equipment is essential to modern science. It is anticipated that better trained scientists entering graduate and professional schools and beginning professional science careers will result.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

George M. Drew	TPE 8651464
Maurice H. Field	FY86 $123,121
James Hadden	FY88 $105,650
University of Tennessee Martin	FY89 $136,090
Martin, TN	Elem Science

"Program for the Enrichment of Science Instruction in Elementary Schools in Rural Tennessee"

The Center of Excellence for the Enrichment of Science and Mathematics Education at the University of Tennessee at Martin is charged with the responsibility of rendering service to public schools in mathematics and science education in the state of Tennessee. This project is designed to provide that service in elementary science in three Educational Service Centers in rural settings. Teams consisting of one primary teacher, one intermediate teacher, one principal, and one supervisor, from the same school, will be formed. Major effort will be expended to find minority participants and those interested in mainstreaming handicapped children. Three of these teams will be formed in each of the three Education Service Centers. These teams of exemplary educators will participate in an intensive eight-week summer session designed to increase competency in content and teaching strategies. Once trained, they will redesign the elementary science programs in their home schools. When that task is completed, the teams will move on to serve other institutions. These involvements will take the form of team members working in classrooms as trainers of teachers and with appropriate administrators.

Support for the teaching teams during the academic year will be provided by "Level III" teachers who will serve as field supervisors, the science consultant for the State Department of Education, and the project staff.

COLLEGE SCIENCE INSTRUMENTATION

Charles E. Harding	USE 8851275
University of Tennessee Martin	FY88 $26,283
Martin, TN	Chemistry

"Undergraduate Instruction in Gas Chromatography/ Mass Spectrometry"

Technological advances over the past few years have produced some remarkable changes in laboratory instrumentation. It is essential that undergraduate science students develop a thorough understanding of both the theoretical and practical aspects of modern computer-controlled / computer-interfaced instrumentation. One of the most powerful instrumental methods for separating and identifying the components of a complicated mixture is Gas Chromatography/Mass Spectrometry (GC/MS). Students of Chemistry, Biology and other sciences are being educated in the theory, operation, practices and capabilities of this powerful technique. GC/MS is being introduced into Analytical and Organic Chemistry during the sophomore year. Six upper-level courses are being improved to give the student ample opportunity to gain proficiency in the technique. The infrastructure of science is being strengthened when young scientists no longer have to remove, in graduate schools and in industrial laboratories, deficiencies accumulated as undergraduates because of the lack of the state-of-the-art instructional scientific equipment.

The grantee is matching the award from non-Federal sources.

TEACHER PREPARATION PROGRAM

Elizabeth Goldman	TPE 8751472
Horace E. Williams	FY87 $163,602
Vanderbilt University	FY88 $166,692
Nashville, TN	FY89 $100,000
	Mathematics

"Bridging the Gap Between Theory and Practice in the Teaching of Elementary School Mathematics: Using Research and Technology to Reform Teacher Education"

Mathematicians, scientists, and teacher educators at Vanderbilt University will cooperate with 15 selected exemplary classroom teachers to develop and evaluate a model approach to the preparation of elementary teachers of mathematics. A primary goal is to demonstrate how mathematics content and pedagogy are blended in the design of effective mathematics instruction. Elementary teachers will help mathematicians and mathematics educators plan instructional units and classroom activities which the teachers will then model for videotaping in their own classrooms. From these demonstrations, videodisc materials will be produced. Materials will be implemented and evaluated in the methods of teaching courses, and the preservice teachers will be placed in the classrooms of the exemplary cooperating teacher for actual implementation of teaching ideas. The materials and cooperative model are designed to ensure that participants are aware of research-based principles of effective mathematics teaching and that they have a supportive environment in which to practice these strategies.

Project evaluation will include systematic formative and summative assessments of project strategies, accomplishments, and consequences. It is expected that university course materials, including print and videodisc/computer components, will result. Further, plans have been made for disseminating the model and materials throughout Tennessee as well as nationally.

TEXAS

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Adriano M. Gonzalez
Science
Oliver W Holmes High School
San Antonio, TX

Susan G. Blumenthal
Mathematics
Quail Valley Junior High School
Missouri City, TX

1988

Laura J. Niland
Mathematics
Douglas MacArthur High School
San Antonio, TX

Nancy H. Klepper
Science
Clark High School
San Antonio, TX

COLLEGE SCIENCE INSTRUMENTATION

Peggy Alley	USE 8852342
Amarillo College	FY88 $21,307
Amarillo, TX	Chemistry

"Instrumentation and Laboratory Improvement in the Chemistry Department"

The Chemistry laboratory offerings are being upgraded with the acquisition of Spectronic 20 model D spectrophotometers and Westronics recorders, a Shimadzu UV spectrophotometer, electronic balances and a Perkin Elmer FT-IR 1600 spectrophotometer. Instrumental methods are being introduced into Freshman courses followed by expanded usage in the Sophomore courses. Students are preparing inorganic and organic compounds and then using the instruments to characterize them, as well as study their spectroscopic properties. By using both Spectronic 20's and a recording UV spectrophotometer, students are being given the opportunity to see the impact that instrumentation can make on a determination.

The grantee is matching the award from non-Federal sources.

PRIVATE SECTOR PARTNERSHIPS

John Friedrick	TPE 8851036
Freda Holley	FY88 $162,884
Austin Independent School District	FY89 $175,116
Austin, TX	Elem Science

""Double TNT" - Targeting New Teachers and Teaching by Novel Techniques"

Using minority and female junior and senior high school students to work with elementary teachers in presenting science activities in their elementary classes ("Teaching by New Techniques"). "Double TNT" will both seek to interest elementary students, particularly minorities and females, in science, and to interest older students in the possibility of careers in teaching ("Targeting New Teachers"). The junior and senior high school students will come from The Science Academy of Austin, a unit of the Austin (TX) Independent School District, and a consortium of local industries. They will work with teachers at both levels to develop science teaching units that they can present at the elementary level, both in person and via videotape, thereby serving as role models. They will also serve as mentors to sixth grade students who visit the Science Academy. The Science Academy will also work directly with elementary teachers in teacher enhancement programs and will actively seek to interest minority and female elementary students to apply for the Science Academy.

Cost sharing by the partners is estimated to total at least 75% of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Michael T. Griffin	USE 8851662
Bee County College	FY88 $12,993
Beeville, TX	Biology

"Equipment for an Undergraduate Microbiology Laboratory"

This project is providing a modern, safe steam autoclave for the sterilization of culture media and supplies used in the teaching of Microbiology to undergraduates, most of whom are Hispanic women. The acquisition of a new modern steam autoclave provides the department with a more efficient and reliable means of preparing bacteriological culture media. This improvement benefits the students enrolled in Microbiology courses by providing them with the required materials for instruction in the culture and identification of microorganisms.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Treacy L. Woods USE 8851142
Houston Baptist University FY88 $26,150
Houston, TX Chemistry

"Use of Hands-On Nuclear Magnetic Resonance Spectroscopy to Strengthen the Organic Chemistry Laboratory Program"

With the acquisition of a nuclear magnetic resonance spectrometer the Chemistry Department is strengthening its laboratory courses by providing students with additional opportunities to use instrumentation. Compound identification capabilities are being increased, particularly in the Organic Chemistry Analysis Laboratory. However the students also take a Senior Seminar, which is an undergraduate laboratory research course, where the instrument is having a decided impact on the nature of the problems that can be undertaken.

The grantee is matching the award from non-Federal sources.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Carolyn T. Summer MDR 8751878
Terry L. Contant FY88 $798,632
Houston Museum of Natural Science FY89 $667,197
Houston, TX FY90 $258,516
Elem Science

"The Science Connection"

This supplementary program for grades 1-6 is designed to take advantage of an existing vehicle, those basal science textbooks now in broad use, to improve the quality and quantity of science being taught. The materials described below will include correlations to those programs.

A Science Discovery Reader for each grade level will introduce concepts within the context of student experiences, and will be fun for children to read. Critical thinking questions throughout these books will check understanding of the concepts being taught, and teacher editions will suggest additional activities and references.

The Science Shoebox Recipe File will provide teachers with plans for self-contained, hands-on activities. These activities will coordinate with the plot and action of stories in the Science Discovery Reader.

The Science Extension relates the concepts developed in the basal textbook series and in the Science Discovery Reader to other school disciplines and to students' out-of-school environment.

Ancillary audio and video tapes will also be available.

The Co-Principal Investigators will have the support of their own institution, the Houston Museum of Natural Science, plus an array of university and school advisors, and a major educational publisher. Silver, Burdett and Ginn publishing company will provide strong staff and financial support, from development through dissemination and teacher training, and assures potential for broad use of this program in our schools.

COLLEGE SCIENCE INSTRUMENTATION

Catalina Fresquez USE 8750970
Gerald F. Doebbler FY87 $11,696
Incarnate Word College Biology
San Antonio, TX

"Equipment for Undergraduate Instruction in Biochemistry, Molecular Biology and their Applications in Biotechnology"

Two laboratory courses are being developed which are giving undergraduate Biology majors experience with state-of-the-art techniques in modern Biochemistry and Molecular Biology. The project's focus is on preparing Hispanic women and other minority and non-traditional students for careers in local Biotechnology-based industries. Courses affected include (in addition to Biochemistry) DNA Technology, Genetics and Immunology.

Existing equipment for spectrophotometry, ultracentrifugation and isotope counting is being supplemented by essential additional electrophoretic and chromatographic equipment obtained through this grant, making it possible to offer laboratory work in courses where previously such opportunities were lacking.

YOUNG SCHOLARS

Robert J. Palma, Sr. RCD 8850057
Midwestern State University FY88 $28,831
Wichita Falls, TX FY89 $28,831
Chemistry

"Teaching Chemistry for Rural Students with Chemical Research"

The Chemistry Department at Midwestern State University (MSU), which has 10 years experience in working with high school students (Project SEED), has designed an eight-week research projecs for 12 high school students, with no more than three students to a professor. The students also receive formal career counseling, minicourses in technical writing, research methodology, and Special Topics in Chemistry. Field trips to several outstanding research laboratories and participation in two student-faculty panels on philosophy and ethics are included. Most of these activities continue at M.S.U. on one or more Saturdays each month during the academic year.

TEACHER ENHANCEMENT PROGRAM

R. O. Wells, Jr.	TPE 8652030
Rice University	FY87 $159,893
Houston, TX	FY88 $191,439
	FY89 $165,331
	Mathematics

"Rice University School Mathematics Project"

This project will establish a working relationship between high/middle school mathematics teachers and university research mathematical scientists in the Houston area by establishing a research mentor/ master teacher program. There will be intensive summer institutes and academic year programs taught by the master teachers, mathematical scientists and educators. The Houston Independent School District is the fifth largest school district in the nation, with 60% of the students and 50% of the teachers from minority groups. The goals are to develop a school system/university model in which the participating teachers' mathematical scholarship and teaching strategies are enhanced and sustained by their interactions with research mathematicians, statisticians, computer scientists, and mathematics educators.

The mathematical content will include current topics in linear algebra, probability, statistics, numerical methods, number theory, algorithms, geometry, logic, and computers. The impact of mathematics and computer science on contemporary science, technology, and society will also be explored. The project will develop and publish pre-college level teaching units, videos of demonstration lessons and related materials, and a mathematics newsletter.

For three successive summers (1987,1988,1989), 48 teachers will participate on Rice University's campus in six intensive weeks of lecture/problem solving workshops, seminars, colloquia, group study, peer group presentations, and preparation of secondary level teaching units. The instructors of the workshops will be six master high school teachers, who developed the content/teaching strategies with six mentor university mathematical researchers and educators during the spring of 1987. At the start of the project, participants will be instructors who teach in a gifted/talented program. In the second and third phases, teachers of regular classes will also be selected. During the academic year there will be monthly workshops, seminars, and a yearly conference on Rice University's campus.

This project will be a high quality mathematical model for a long-term school system/university researcher' partnership to improve pre-college mathematical instruction.

COLLEGE SCIENCE INSTRUMENTATION

Stillman E. Sims	USE 8852311
St Mary's University	FY88 $45,448
San Antonio, TX	Mathematics

"A Microcomputer Lab for a New Degree Program in Mathematical Science"

A microcomputer laboratory of varying capacity IBM computers in the Department of Mathematics at St. Mary's University, San Antonio will facilitate the development of a new Bachelor of Science program in Applied and Computational Mathematics. A new course in mathematical modelling will be introduced and computers will be integrated into several mathematics courses starting with the Calculus sequence.

The award will be matched by an equal amount from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Harold F. Foerster	USE 8750770
Sam Houston State University	FY87 $11,587
Huntsville, TX	Biology

"Undergraduate Laboratory Equipment for Teaching Molecular Biology and Biotechnology"

Students in Molecular Biology are carrying out experimental analyses of genes and their proteins with special emphasis on methodologies used to study recombinant DNA and gene cloning. The instrumentation purchased through this award is being used for the electrophoresis procedures which chemically separate and identify proteins and DNA fragments. The major equipment items include vertical and horizontal slab gel electrophoresis units and various supportive instrumentation -- a microcentrifuge, scanning densitometer, constant temperature incubator, shaker bath, analytical balance, and pH meter.

The student experiments are being developed around a model gene-protein system in Bacillus, a spore-forming group of bacteria in which heat-resistant spores are produced that contain sizeable quantities of small, acid-soluble proteins (SASP). Such proteins play important, but not yet fully understood, roles in spore germination. Students are isolating and identifying SASPs, and are determining the number of genes involved in the coding their production.

YOUNG SCHOLARS

Paul J. Fonteyn RCD 8850140
Alton J. Banks FY88 $59,571
Southwest Texas State University FY89 $59,571
San Marcos, TX Life Sciences

"A Summer Science Experience for Young Rural Scholars"

The primary objective of this project is to offer a four-week hands-on science program at Southwest Texas State University for 24 eighth-grade students from Texas rural schools with minimal science opportunities. Participants develop both analytical and communicative skills necessary for success in college science programs. This objective is accomplished in a peer/mentor residential setting, through interactions with prominent scientists, field experiences at major urban research centers and guided scientific experiments with state-of-the-art scientific instruments. The participants' final experiments, performed during school year follow-up activities are published. Students present their experiments at state-wide science fairs and conferences in collaboration with their school science teachers.

COLLEGE SCIENCE INSTRUMENTATION

Norman M. Whalen USE 8852746
Southwest Texas State FY88 $9,684
San Marcos, TX Anthropology

"Scientific Instruments for Undergraduates in Archaeology and Physical Anthropology"

The scientific equipment provided by this award enhances the quality of introductory and advanced courses in Archaeology and Physical Anthropology by enabling undergraduate students to experience hands-on use of instruments in the classroom, laboratory and field program settings. Two surveying instruments, a theodolite and an alidade, greatly improve student competence in field situations involving archaeological surveying and mapping and expand the range of their performance to include skill in the use of equipment common to Old World as well as New World archaeology. The microscopes provide laboratory opportunity for students to observe and identify cellular structure and histology of bone tissue and the nature of wear patterns on hominid teeth. Physical anthropology students use the calipers and microscope provided to measure and examine specimens in the search to identify and distinguish different species of human and nonhuman primates.

The award will be matched by an equal amount from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Dwight Goode USE 8852083
Texas A & I University FY88 $19,213
Kingsville, TX Mathematics

"Calculus Enhancement Project"

With the recognition that current industrial uses of mathematics includes numerical, graphical and symbolic systems, the faculty wants to enhance their Calculus instruction with an open lab that would be available for demonstrations and student homework assignments.

The award will be matched by an equal amount from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Ronald E. Marcotte USE 8851305
Texas A & I University FY88 $26,591
Kingsville, TX Chemistry

"Analysis of Natural and Synthetic Organic Mixtures in an Undergraduate Laboratory"

The project is allowing students to experience one of the most powerful, modern techniques of chemical mixture analysis. The ability of the University to analyze organic substances is being greatly enhanced by the purchase of a benchtop Gas Chromatograph/Mass Spectrometer (GC/MS) System. Methods for analysis of air-borne and water-transported organic components from the many petroleum, petrochemical, and agricultural industries in South Texas are being developed in Environmental Chemistry. In Instrumental Analysis, applications of this modern technique are being presented for student instruction. With the GC/MS, experiments exploring reaction mechanisms through product distributions and the use of isotope tracers are being developed for the Advanced Synthesis Laboratory. All of the above activities can apply to problems in Undergraduate Research. The GC/MS is reducing the separation and analysis time needed for many projects to the point where undergraduates can realistically consider completing some quality research during their short tenure. The significance of the project is great for the education of the population of South Texas.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Robert A. Warren TPE 8751856
David L. Zufelt FY88 $190,684
Texas A & I University Elem Science
Kingsville, TX

"A Model to Enhance Elementary Science Teaching in Rural Communities"

A Model to Enhance Science Teaching in Rural Communities is a support system for 40 rural elementary school science teachers consisting of summer institutes, academic year follow-up sessions, and the development of local community and business support for science teaching in each participating rural community. This 24-month program organized by scientists and science educators at Texas A&I University, a designated minority institution, also seeks to improve language skills through science instruction in an area where the predominant language is Spanish.

YOUNG SCHOLARS

Clark E. Adams RCD 8850055
Texas A&M University FY88 $18,039
College Station, TX FY89 $18,039
Natural Sciences

"Examination of Career Options in the Natural Sciences by Young Scholars"

Fifteen young scholars examine career options in the natural sciences (wildlife ecology, fisheries/aquaculture, or museum science) in a residential setting at Texas A & M University. Project activities include 14 days of instruction, problem solving, exposure to the research environment and contemporary methods, career exploration, and consideration of the philosophy and ethics within the natural sciences. Young scholars enhance their career planning through identification of options, discussions with career professionals, and on-site visits to selected research and educational facilities. A planned 2-3 year follow-up of participants will determine the degree to which project goals were achieved.

TEACHER ENHANCEMENT PROGRAM

Robert B. Clark TPE 8751847
Texas A&M University FY88 $310,727
College Station, TX Physics

"Texas Regional Enhancement Program for Underprepared Physics Teachers"

Texas Regional Enhancement Program for Underprepared Physics Teachers is a model regional cooperative program to provide training in physics content and pedagogy for 24 underprepared high school physics teachers from the State of Texas. Three two-week summer workshops covering topics in classical, modern, and contemporary physics will be offered during the three-year grant period. Academic year follow-up meetings and classroom visitations also are included to provide assistance with implementation and evaluation. Instruction in the program is carried out by a team consisting of highly experienced high school physics teachers (Physics Teaching Resource Agents) and a university faculty member. Participants will receive three units of graduate credit for successful completion of each year of the program.

YOUNG SCHOLARS

Ronald Darby RCD 8850073
Texas A&M University FY88 $44,151
Texas Eng Experiment Station FY89 $44,151
College Station, TX Chemical Eng

"Young Scholar Program - for High Ability and High Potential Secondary School Students with Orientation Toward Chemical Engineering"

This program brings eighteen high school students (grades 10-12) to the campus of Texas A&M University for career orientation and instruction relevant to science and engineering, with special emphasis on Chemical Engineering. The program duration is four weeks, and the students reside in dormitories on the Texas A&M campus. Activities include work on a research project under the direction of Chemical Engineering faculty members, lectures, seminars, discussions, and field trips. The instruction, discussions, and field trips emphasize career orientation, communications skills (both written and oral), and problem solving methodology (both in class and with microcomputers). Instructors include Chemical Engineering faculty and graduate students, staff from the Speech Communications Department, invited speakers from other areas of the campus and industry representatives.

COURSE AND CURRICULUM

Carl A. Erdman USE 8854512
David G. Jansson FY88 $274,187
Texas A&M University FY89 $362,195
College Station, TX FY90 $249,484
FY91 $176,209
FY92 $147,500
Engineering

"A Restructured Engineering Science Core with a Design Component"

This project changes the way the engineering curriculum is structured by: 1) repackaging the material taught in the basic engineering sciences into five courses, each of which is based on similar scientific and mathematical background; 2) including in these revised engineering science courses significant engineering design experience. These steps will address several concerns about engineering curricula including: 1) the increasing number of "basic" engineering science courses that result from identifying these courses with the various engineering disciplines; 2) the separation of engineering design from engineering science in the minds of students with the consequent lack of appreciation for the interaction of engineering science with engineering design; 3) an apparent loss of interest by students in creative engineering efforts as a result of the heavy doses of analysis in the engineering sciences. Institutional funds committed to this project are approximately one-third of NSF funds.

This project is co-funded with the NSF Directorate for Engineering.

RESEARCH IN TEACHING AND LEARNING

Donald F. Dansereau	MDR 8751369
Selby H. Evans	FY88 $95,875
Texas Christian University	FY89 $98,857
Fort Worth, TX	FY90 $97,457

"Concept Maps and Scripted Cooperation: Interactive Tools for Improving Science Education"

This project will examine the impact of two interactive information processing tools on science teaching and learning at lower undergraduate and upper high school levels. These tools, which have emerged from our prior research on technical and academic learning strategies, are: Concept Mapping, a method of converting information to two-dimensional node-link displays, and Scripted Cooperation, an approach to orchestrating the joint processing of information by peer dyads. These tools will be used independently and interactively to enhance the extraction of scientific knowledge from experts, the presentation of this knowledge to students, and the subsequent processing of the communicated information. Expert maps of biological and statistical concepts will be developed and used in a series of six experiments designed to assess the impact of the information processing tools on a variety of science education outcomes. These experiments, which will involve approximately 660 college freshmen and high school seniors, will also examine Aptitude X Treatment interactions and transfer to other learning situations.

The results of this experimentation will be used to further develop a model of science education and will be used as a basis for developing implementation materials for practitioners.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Paula Hardy	MDR 8751386
Stephen Brown	FY88 $199,599
Dava Coleman	FY89 $164,372
Jean Holden	FY90 $192,566
Texas Learning Technology Group	Physics
Austin, TX	

"Interactive Videodisc Physical Science Curriculum"

The Texas Learning Technology Group (TLTG) is attempting to develop, pilot and implement a physical science curriculum, entitled the Interactive Videodisc Physical Science Project. The outcome of this project, which incorporates the latest developments in the use of advanced technology, will be a comprehensive 160-hour, two-semester science curriculum, applicable to schools nationwide. The course will be targeted primarily for use with middle school students in the eight and ninth grades where physical science is traditionally taught. However it will be equally appropriate at the tenth grade level. The objective of this effort is to develop a comprehensive physical science curriculum, which has a technology-based delivery system using integrated computer, video, and audio components, and improves learning by increasing the students's in-depth understanding of physical science concepts and skills, by increasing student interest in science, and by improving the ability of teachers to teach science. The TLTG effort is the first national project to develop a complete curriculum (including courseware, teacher resource guides, student manual, classroom management system, and testing system) delivered primarily via interactive videodisc. By utilizing interactive videodisc technology in a comprehensive manner not previously explored to this extent, this project integrates a myriad of sound instructional, technological approaches with proven effective traditional modes of instruction.

This project has attracted a significant amount of contributions from private sources both in terms of cash and equipment. It appears that the private sector is becoming more and more aware of the need both to improve science instruction and to use new technologies to better realize the improvements. If the project continues to be as effective as the prototypes suggest, it will stand as a high quality model for adaptation by schools across the country.

COLLEGE SCIENCE INSTRUMENTATION

Donn D. Martin	USE 8853346
Texas Wesleyan College	FY88 $28,220
Fort Worth, TX	Biology

"Computer-Interfaced Physiological Equipment for Undergraduate Instruction"

The objectives of this project are to give students experience with state-of-the-art analytical equipment, and to increase their familiarity with

Quantitative Biology. To address these issues, this department is equipping its Physiology Laboratory with four computer-interfaced data acquisition systems with physiological monitors for the measurement of bioelectrical and biomechanical activities. These data acquisition systems, supported by the appropriate software, are capable of data storage, analysis, manipulation, and retrieval. The simulation capabilities of the computer may be exploited also for the visualization of equations used for modeling various physiological processes. Students then may compare the theoretical and actual outputs of each physiological system studied.

Processes to be studied using this equipment include muscle, skin, and nerve activity, cardiovascular physiology, respiration, and glandular secretion. Mastery of this equipment provides the undergraduate with a background for understanding the operation principles of other types of equipment using the sensor/transducer/ amplifier/ recorder component series. The simulation experience helps students to bridge the conceptual gap between real physiological processes and their mathematical models.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Michael P. Doyle USE 8851397
Trinity University FY88 $17,492
San Antonio, TX Chemistry

"Trace Elemental Analyses in Chemistry and Geology"

Atomic absorption spectroscopy and its uses for trace elemental analyses are being integrated into introductory and advanced courses offered by the Departments of Chemistry and Geology. Introduction to this fundamental analytical capability, whose applications extend into virtually every field of inquiry where accurate measurements of specific metals are required, is occurring in the first course in Chemistry, with advanced courses in Instrumental Analyses and Geochemistry expanding upon the initial experience. New instructional materials and laboratory experiments are being developed to facilitate student understanding of this technology and its broad applications in all fields of materials science. Application of atomic absorption spectroscopy suitable to nonscience majors and preservice teachers is being implemented, and access and instruction is being provided to area high school classes for their ongoing environmental research. Development of this program is being achieved through the purchase of an atomic absorption spectrometer equipped with a sample changer and accessories needed to obtain quantitative analyses at the part-per- billion range.

The grantee is matching the award from non-federal sources.

Michael P. Doyle USE 8751896
Trinity University FY88 $20,000
San Antonio, TX FY89 $21,000
FY90 $22,000
Other NEC

"National Conference on Undergraduate Research"

The National Conference on Undergraduate Research provides increased national awareness of the importance of research experiences in the education of undergraduate students. The first conference, held in April, 1987, demonstrated, through the attendance of more than 450 students, faculty and administrators from over a hundred different colleges and universities located in 30 states together with the enthusiasm of the participants, the need for this conference as an annual event. With funding provided by the National Science Foundation, future conferences will attract additional participants, especially under-represented groups, who have the ability to advance the development of research with undergraduate students in their institutional environment and nationally.

This project is co-funded with numerous elements of the Foundation.

COLLEGE SCIENCE INSTRUMENTATION

Nancy S. Mills USE 8750180
Trinity University FY87 $14,540
San Antonio, TX Chemistry

"Optical Activity Determinations in Chemistry and Biochemistry"

Spectropolarimetry is being fully integrated into the undergraduate chemistry curriculum at Trinity University. A polarimeter equipped with a monochrometer and continuous sources affords applications that demonstrate the essential characteristics of optical activity measurements in understanding the 3-dimensional structure of chiral molecules. Determination of the optical rotations of inorganic complexes and organic compounds, the measurement of optical rotatory dispersion curves in conformational analyses and base stacking of nucleosides, and the determination of the specific rotation of pure enantiomers by modern methods are among the activities students are experiencing.

TEACHER PREPARATION PROGRAM

Edward C. Roy, Jr.
Trinity University
San Antonio, TX

TPE 8751492
FY87 $79,447
FY89 $30,628
FY90 $26,795
Other NEC

"Excellence in Science Education Teacher Preparation Program"

Trinity University will modify their existing science teacher preparation program with the addition of five interrelated educational components. These are: (1) a workshop for prospective science majors with emphasis on teaching science as a career; (2) the establishment of 10 scholarships for students who will major in science and who have a substantial interest in teaching careers at the secondary level; (3) the development of a new course, "Controversy in Science and Technology," that will critically examine the history, development, and implications of scientific and technological issues confronting society; (4) the development of a second new course, "Innovation in Science Education," that will provide prospective secondary science teachers opportunities to develop unique and innovative approaches to science instruction in an independent study program; and (5) the development of a third new course, "Discovery," that integrates the basic disciplines of science that are suitable for prospective elementary school teachers, coupled to a mentorship program for prospective secondary science teachers. These modifications in the Trinity University program will make it an adaptable model for teacher preparation at comparable liberal arts colleges.

COLLEGE SCIENCE INSTRUMENTATION

Diane R. Smith
Trinity University
San Antonio, TX

USE 8750215
FY87 $38,650
Geology

"Energy-Dispersive X-ray Fluorescence Spectrometry: Undergraduate Applications in Geology and Geochemistry"

A "hands-on" understanding of the techniques and applications of whole-rock geochemical analysis is an essential part of a student's undergraduate preparation in Geology. The Department of Geology at Trinity University will integrate an energy-dispersive x-ray fluorescence spectrometer system (ED-XRF) into its undergraduate curriculum. All students whose eventual careers might require the application of geochemical principles will be exposed to the multiple uses of this technique. The instrument will be used as a tool in courses and research, with an emphasis on its use in solving geologic problems including the origin of igneous, metamorphic, and sedimentary rocks and ore deposits. Development of the program will be achieved through the acquisition of an ED-XRF which has capability to produce quantitative, multi-element analyses of silicate rocks.

TEACHER ENHANCEMENT PROGRAM

George W. Bright
University of Houston
Houston, TX

TPE 8751473
FY88 $196,676
Mathematics

"Advanced Technology Education of Middle/Junior High School Mathematics Teachers"

The main goals of the project are to provide experienced mathematics teachers at the middle and junior high school levels opportunities to immerse themselves in the use of technology to explore and to teach mathematics, to prepare leaders among the teachers who can communicate their technological knowledge to other teachers, and to produce teaching materials built around the technology which can be used for workshops as well as for student instruction.

Twenty participants are selected from among those recommended by the school districts that are committed to the project. The participants take courses during the summers (1988 and 1989) as well as during the academic year that deal with investigations on mathematics and pedagogical topics, such as probability, problem solving, and geometry, and the development of curriculum materials. There is also an interwoven strand of courses that emphasizes technology-related topics, such as computers in the classroom, and that uses technology to teach instructional computing research, mathematics, and problem solving.

TEACHER ENHANCEMENT PROGRAM

John L. Creswell
Univ of Houston University Park
Houston, TX

TPE 8550514
FY86 $126,384
FY87 $151,749
FY88 $ 15,000
Mathematics

"To Train Prospective Master Teachers in Middle School Mathematics Using a Problem Solving Format"

This Leadership Activities project will provide enhancement and professional development experiences for 30 exemplary middle school mathematics teachers from the Houston, Texas area. The overall goals of the multiyear project involve the updating and deepening of the participants' mathematical backgrounds and teaching methodology, the networking of the participants, the conduct of in-service workshops by the participants in their home schools, the dissemination of the project materials and results to nearby school systems, and the investigation of the modelistic approach within a carefully planned documentation, assessment and evaluation effort.

Working under the assumption that leadership potential involves special characteristics, the project team and Advisory Board, which consists of representatives for 10 cooperating school districts, will engage in a thorough selection process. Documentation of the individual participant's entering characteristics and the competencies developed through project activities will contribute to the overall project evaluation.

Participants will complete four special mathematics courses designed to encompass the CUPM recommendations for junior high school teachers, earning 12 graduate semester credits for the University of Houston. They will study with university faculty chosen for their excellence in teaching teachers. Mathematics studies will include ideas from mathematical problem solving, probability and statistics, history of mathematics, abstract algebra, number theory, and geometry. Participants will also complete 15 graduate semester hours of studies related to the pedagogy of middle school mathematics. Uses of microcomputers, diagnosis and remediation, and problem-solving strategies will be featured. During the in-service workshops which the participants will design and conduct, project staff will be available for consultation and support. Participants will be visited, observed, and videotaped in their classrooms and in their workshops with their peers. Careful documentation and analysis of these observations and recordings will provide a significant basis for a detailed project evaluation.

TEACHER ENHANCEMENT PROGRAM

Mamie W. Moy	TPE 8470565
Hugh T. Hudson	FY85 $186,879
Univ of Houston University Park	FY86 $134,570
Houston, TX	FY87 $131,984
	HS Science

"Improving Instruction in the High School Physical Science Course"

In this project, conducted over a three year period, 120 high school physical science teachers (40 each year) from the greater Houston area will participate in an academic year workshop to be held on the University Park Campus of the University of Houston. Participants will be chosen such that a significant fraction of the physical science teachers from selected high schools will be involved in the project, which will insure the presence of a critical nucleus of trained teachers at each site after the project is completed. Science Coordinators and Principals from the school districts and participating high schools will be involved in the project by serving on an advisory committee. Institute activities will focus on training in the content of physics and chemistry in the physical science course, correcting misconceptions and incorrect science in the textbooks, and developing course materials, laboratory exercises and demonstrations for use in the high schools.

COLLEGE SCIENCE INSTRUMENTATION

Carol Jones	USE 8750352
Univ of Houston Downtown College	FY87 $42,000
Houston, TX	Mathematics

"Integration of Microcomputer-based Instruction into Business Statistics Courses"

This project will support instrumentation in the Applied Mathematical Sciences Department of an open-admissions college. A classroom will be equipped with twenty-five networked IBM-PC (or IBM compatible) microcomputers and a large scale projection screen for demonstration purposes. The equipment will be used in two junior level statistics courses which are required of business majors. Students will encounter daily assigned classroom problems dealing with decision-making situations which require statistical analysis and interpretation of computer output. Solutions will be worked out on computers (two students per machine), as in a lab. Mathematically-shy business students will have a greater appreciation of statistical concepts and their applications to real world problems, more experience in dealing with the popular IBM-PC machinery and increased interest in pursuing optional senior level math courses in the area of the decision sciences. Business students, who represent fifty-eight percent of UH-Downtown's 1986 graduating class, will receive enhanced training in quantitative methods. Ultimately, other faculty will be encouraged to use this instructional lab for courses in computer science, numerical methods and calculus.

COURSE AND CURRICULUM

Ronald E. Barr	USE 8854623
Davor Juricic	FY88 $77,950
University of Texas	FY89 $90,684
Austin, TX	Engineering

"A Modern Curriculum in Engineering Design Graphics"

This project is concerned with the design, development and evaluation of a new curriculum for Engineering Design Graphics that reconciles the current transition from the 2-D design medium (wooden or electronic drafting board) to the new and near-future 3-D design medium (solid modeling system). The project is founded on the premise that 3-D solid modeling systems, using new computer graphics technologies, are becoming dominant engineering design tools for the 1990's, and that new knowledge and visualization skills will be required by future engineers to become successful designers. The equipment and facilities needed for this project are provided by the grantee.

This project is co-funded with the NSF Directorate for Engineering.

FACULTY ENHANCEMENT PROGRAM

Davor Juricic	USE 8854222
Ronald E. Barr	FY88 $63,258
University of Texas	Engineering
Austin, TX	

"Computer Graphics in Undergraduate Engineering Education"

Computer Graphics is a new discipline that has profoundly changed traditional approaches to Engineering Design. This project will present Computer Graphics as a new discipline in engineering curricula and as a significant new tool for Engineering Design and Drafting.

The format of the project is a Seminar/Workshop with a group of 16 carefully selected participants during a three week period. It will include presentations, discussions, demonstrations and other forms of interaction between participants and faculty that are active in teaching and research in the area of Engineering and Computer Graphics.

The project will attract, interest, and enlighten experienced and promising undergraduate instructors teaching Engineering Graphics who need motivation, background, and know-how to develop new Computer Graphics laboratories and to apply leading-edge technology to the teaching of modern, computer aided design and drafting (CADD)-based Engineering Graphics courses. It also promises to prepare participants for and to help them in their efforts to introduce new courses in Engineering Computer Graphics, and to motivate them to become self-reliant in making and publishing their own contributions to this field of Engineering Education.

In addition to NSF support, participants will provide about 10% in travel costs, and the University is contributing an additional 15%.

TEACHER ENHANCEMENT PROGRAM

Thomas R. Koballa, Jr.	TPE 8751801
Lowell J. Bethel	FY88 $325,231
University of Texas	Life Sciences
Austin, TX	

"Pre-College Teacher Enhancement Program for Middle/Junior High School Life Science Teachers"

This teacher enhancement project consists of three full-year cycles, each beginning with a summer workshop and followed by the school year. This design gives the participants an opportunity to interact and learn the biological concepts, processes, and teaching methods, to share and work together with outstanding life science teachers, and to establish and maintain a continuing collaborative partnership with scientists and science educators from University of Texas at Austin.

Twenty-four of the less well-prepared middle/junior high school life science teachers from the counties around the University will be selected for each cycle. Twenty summer and seven fall sessions, a total of 118 contact hours, will be required of participants for which they will receive six semester hours of credit. The summer sessions will include laboratory and field experiences, content presentations by scientists, and small group work periods during which lessons will be prepared. During the fall, in addition to working with the scientists, the participants will prepare instructional units, and special sessions entitled "Middle/Junior High School Kids Meet the Scientist" will be held in the participants' classrooms. A series of visits by two scientists to participants' classrooms will be made during the fall and spring of each yearly cycle.

The participating school districts as well as other non-NSF sources are contributing more than 30% of the cost of the project.

YOUNG SCHOLARS

Irwin Spear	RCD 8850196
University of Texas	FY88 $64,153
Austin, TX	FY89 $64,153
	Life Sciences

"Young Scholars Program in Life Sciences and Biochemistry"

This 8-week summer residential Young Scholars Program emphasizes research participation in the life sciences, biochemistry, physiological psychology, and some earth sciences such as paleontology. To provide a broad perspective and a background for their research participation, special advanced coursework is provided during the mornings of the first four weeks, with research participation in the afternoons. The last four weeks are devoted to full-time research participation, with occasional seminars in the evening.

The coursework includes: lectures and discussions covering selected topics in modern cellular, molecular, evolutionary and developmental biology and biochemistry; readings and discussions of great experiments in biology and biochemistry; and guest lectures by research scientists. Research participation involves the student as a junior member of a research team engaged in on-going research, sometimes on a joint project with members of the team and sometimes on an independent facet of a problem. At the end of the program, the participants submit a written paper and give oral presentations on their research at a two-day simulated professional meeting.

YOUNG SCHOLARS

Manuel P. Berriozabal	RCD 8850001
University of Texas San Antonio	FY88 $183,513
San Antonio, TX	FY89 $183,513
	Engineering

"1988 San Antonio Prefreshman Engineering Program"

The goal of the San Antonio Prefreshman Engineering Program (SA PREP) is to identify high ability high school and middle school students with potential and interest in engineering and science and to reinforce their pursuit of these fields. Project locations include the University of Texas - San Antonio, Palo Alto College and Trinity College. The academic program includes course work in logic and math applications, Introduction to Engineering and Computer Science (first year students); Algebraic Structures, Introduction to Physics (second year students); Vector Algebra and Geometry and Introduction to Technical Writing (third year students). The program enrolls 500 students from grades 7 to 12.

TEACHER ENHANCEMENT PROGRAM

Stuart J. Birnbaum	TPE 8751823
Alan P. Morris	FY88 $57,780
Eric R. Swanson	Geology
University of Texas San Antonio	
San Antonio, TX	

"Field Geology as a Paradigm for Earth Science Instruction"

Thirty middle school teachers from the public and private schools of Region 20 and Northside Independent School District in the San Antonio, Texas area will be given the opportunity to participate in a graduate summer institute utilizing the innovative "trainer of trainers" approach toward enhancing field and classroom instruction in geology.

Prior to the three-week institute, meetings will prepare participants for the course work, provide interaction with university faculty, and introduce the "training of trainers" program. Field work, lecture, and "hands-on" application will target essential elements of earth sciences, which have been already identified by teachers in this region as requiring attention.

A field trip to the Black Hills will introduce the teachers to a stratigraphy that exists in Texas, but is scattered around the state making it difficult to study in a short period of time. This site will make the segmented Texas geology more available and comprehensible to the teachers. This experience will enable them to develop good field trip experiences for their students at more home-based sites.

Approximately 60% of the participants will be from campuses with more than 65% minority students. During the year following the summer component, participants and university faculty will evaluate the results of the program and develop a package consisting of a teaching manual and video recordings for use in future training of teachers. Both pedagogy and content will be emphasized in this project.

COLLEGE SCIENCE INSTRUMENTATION

Alan P. Morris	USE 8853208
University of Texas San Antonio	FY88 $26,697
San Antonio, TX	Geology

"A Microcomputer Facility for Teaching Quantitative Methods in Structural Geology"

This project will provide for purchase of a local-area computer network consisting of a central file-server, seven high-resolution graphics workstations, and peripheral equipment. This system will be used to provide computer-based instruction in Structural Geology. This equipment also will be used in other Geology courses, and for independent research projects by advanced undergraduate students. The Structural Geology component will employ a software package developed at UT, San Antonio.

The grantee will match the NSF award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

Parimal A. Patel	USE 8853283
University of Texas San Antonio	FY88 $95,832
San Antonio, TX	Electrical Eng

"Digital Systems Design Workstations"

This project permits undergraduate students in this institution's Engineering program to study Digital Design in a state-of-the-art environment. The laboratory that supports this project consists of four digital design workstations. Using these workstations, students are exposed to a broad range of simulation capabilities, including standard component modeling, modeling using a high-level language and physical modeling employing actual very large scale integrated circuits. Using such computer-assisted tools, students obtain practical exposure to complex digital design and analysis techniques.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Dennis S. Rushforth	USE 8852667
University of Texas San Antonio	FY88 $21,110
San Antonio, TX	Chemistry

"Enhancement of the Teaching of Instrumental Methods through Fluorescence Spectroscopy"

One goal of experimental instrumentation courses should be to teach students of Chemistry how to use high resolution, high sensitivity equipment. Students should have the opportunity of making measurements near the limit of detectability of this type of instrument and be required to do it well. Most students that continue in Chemistry will find that an important part of their time is spent either in making such measurements or in interpreting them. Sadly, students are often taught to make such measurements on older equipment or on teaching equipment. Often the instrument itself is the biggest source of error in the experiment and students learn how to blame the instrument rather than use it. To challenge students to do their best and to strengthen the instrumentation courses, a high sensitivity, high resolution spectrofluorometer is being used in Instrumental Analysis and in Physical Chemistry. The technique is easy to learn and the instrument is modestly priced. The technique is more sensitive than absorption spectroscopy and is providing a myriad of applications for teaching principles through experimentation rather than just teaching how to turn on a machine. The equipment is also offering an opportunity for interesting and challenging undergraduate research projects.

The grantee is matching the award from non-Federal funds.

COLLEGE SCIENCE INSTRUMENTATION

John L. Schmalzel	USE 8851970
University of Texas San Antonio	FY88 $79,065
San Antonio, TX	Electrical Eng

"Integrated PC-Instrument Workstation Laboratory"

The Senior-level Electrical Engineering Laboratory facilities at this institution have been upgraded to better prepare the students for productive roles in industry. This project provided laboratory workstations that allow students to integrate analysis and design software tools with measurement instrumentation. The integrated workstations allow the faculty to not only cover traditional electronic circuit problems in much greater depth, but also allow coverage of a much broader range of topics. The major components of the workstation consist of the Hewlett-Packard PC Instrumentation System, an 80283- based AT configured with a floating-point co-processor and a 71-Mbyte hard disk, and the ASYST signal analysis software. With the workstations, students are able to efficiently move between analysis and measurement which facilitates the iterative approach to circuit design. An additional benefit is student familiarity with automated measurement systems similar to that found in the automatic test environment in industry.

This award is being matched by an equal sum from the grantee.

UTAH

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Linda J. Preston
Science
Park City High School
Park City, UT

Steven T. Cottrell
Mathematics
Woods Cross High School
Woods Cross, UT

1988

David N. Pehrson
Mathematics
Skyline High School
Salt Lake City, UT

Dwight G. Brown
Science
Bountiful High School
Bountiful, UT

INFORMAL SCIENCE EDUCATION

Von Del Chamberlain	MDR 8550952
Hansen Planetarium	FY86 $67,882
Salt Lake City, UT	FY87 $28,884
	Astronomy

"A Nationally Distributed Planetarium Star Program and Chart on Galaxies"

The Hansen Planetarium, a leader in the planetarium field, will develop, produce and distribute a 45-minute planetarium program about galaxies, the fundamental building blocks of the universe. Major efforts to translate data about galaxies for the general public have been few and planetaria are an extremely effective medium to pursue this effort.

Based on the Hansen Planetarium's experience in distributing 11 star programs, including the very successful and effective program "The Universe of Dr. Einstein" which was shown in over 666 planetaria, this program is expected to be used by approximately 300 planetaria reaching several million people. The program will be written by Timothy Ferris, author of the best-seller Galaxies. The Hansen Planetarium has recruited a highly talented and respected group of astronomers who will serve as scientific advisors to the project. A science teacher will also serve on the advisory committee to ensure that development of the teacher's guide is written at the appropriate grade level.

To supplement the star program, the Hansen Planetarium will research, design, produce and market a teacher's guide and a full-color educational chart on galaxies.

TEACHER ENHANCEMENT PROGRAM

James S. Cangelosi	TPE 8751300
Utah State University	FY87 $100,000
Logan, UT	FY88 $135,205
	FY89 $256,989
	Mathematics

"Improvement of Middle and Junior High Math Teaching Through Materials for Inservice Education Delivered via Telecommunications Networks"

This two-year project will design, develop, produce, and evaluate instructional materials for incorporation in inservice programs to be delivered to underprepared middle and junior high school mathematics teachers in Utah via telecommunications networks. The materials will focus on the specific needs identified by the Underprepared Math Teacher Assessment Project and will include: (1) video lecture and discussion presentations enhanced with computer graphics; (2) videos of model lessons conducted by exemplary middle and junior high school teachers; (3) videos analyzing problems and situations commonly confronted by middle and junior high school math teachers; (4) a guidebook with exercises, explanations, and resource information to be used in conjunction with the videos. These tapes will have open and closed caption for use by hearing impaired teachers.

This Utah State University project involves classroom teachers, local school districts, Utah Office of Education, and national review boards. There is significant cost sharing by the school districts, the State of Utah, and the University.

TEACHER ENHANCEMENT PROGRAM

Patricia Henry	TPE 8652398
Maurice J. Burke	FY87 $148,725
Weber State College	Mathematics
Ogden, UT	

"Teaching Middle School and Junior High School Mathematics Teachers to Use the Personal Computer as a Teaching Tool"

This school system/academic/AT&T partnership will establish a year-long computer science program for mathematical instruction for 46 teachers from 23 middle/junior high schools in the Ogden, Utah area. The immediate goals are to:

- assist experienced teachers develop mastery of BASIC and LOGO for mathematics instruction under the exploration, problem solving and demonstration models;
- provide two teachers from each school with a classroom microcomputer, modem and printer donated by AT&T;
- create a computer educational network between the middle/junior high schools and Weber State College;
- establish logistics for participating teachers to become lead teachers of in-service computer workshops for their colleagues.

During an academic year and intensive six-week summer program, Weber State College in Utah will provide computer labs and teach courses/labs for 23 teams of two teachers (from the same school) located in three school districts. Eight academic credits will be awarded for coursework on the use of computers in middle/junior high school mathematics classes, and the development of workshops to be taught by the participating teachers. While taking these courses the participants will use the computers in their classes. There will also be a hot line, computer network and classroom clinics.

TEACHER ENHANCEMENT PROGRAM

Patricia Henry TPE 8751845
Weber State College FY88 $145,775
Ogden, UT Mathematics

"Workshop for Secondary Mathematics Teachers - Content and Methods Using the Computer as an Instructional Tool"

This one-year project, which contains strong components in both mathematics content and methodology, will facilitate the use of computers in middle and high school classrooms. Ten superior secondary school mathematics teachers will provide an inservice training program to sixty middle and high school mathematics teachers from Utah, southern Idaho, and western Wyoming. During an intensive two-week summer session, these ten teacher-leaders will offer a total of five courses in the structure of the number system, geometry, algebra, probability and statistics, and discrete mathematics. These courses will combine instruction in mathematics content with preparation in the use of materials that employ the microcomputer as a teaching tool. During the academic year, the participants will be visited by the PI and will communicate with each other via an existing computer network that contains hundreds of computer-based classroom activities.

The project will demonstrate a cost-effective method of conducting inservice programs through the use of teacher-leaders as instructors. The participants' schools will provide computers, modems, and other support for the computer network, and Weber State College will contribute an amount equal to 10% of the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Rondo N. Jeffery USE 8750830
Weber State College FY87 $18,027
Ogden, UT Physics

"Acquisition of Gamma-ray Spectrometer System for Undergraduate Nuclear Physics Laboratory"

Significant revisions have recently been made in the curriculum of the senior-level modern physics theory course at Weber State to include Nuclear and Particle Physics as a distinct subject area. A corresponding change in the Modern Physics Laboratory course is planned. The Physics Department will acquire an IBM-PC-based multi-channel analyzer system (MCA), a high resolution HPGe gamma-ray detector, and fast timing detectors, with associated electronics components for this nuclear physics lab. This will permit a wide range of nuclear experiments to be carried out in this laboratory that are not currently possible with available equipment. In addition to the laboratory course, the equipment will also make possible student research projects in nuclear and solid state physics. The computer-based MCA will give students an opportunity to work with computer-interfaced scientific equipment which is invaluable to their training as physicists.

COLLEGE SCIENCE INSTRUMENTATION

G. Reed Marchant USE 8750603
Weber State College FY87 $50,000
Ogden, UT Industrial Eng

"Upgrading an Undergraduate Engineering Technology Process Instrumentation and Control Laboratory"

This project is to set up a process instrumentation and control laboratory within the industrial automation laboratory. Included will be a process control simulation system, consisting of simulators, PID controllers, discrete controllers, programmable logic controllers, and process simulation microprocessors. The laboratory will use industrial grade instrumentation and IBM PC compatible computers to insure maximum versatility and compatibility. The students will thus learn control techniques ranging from PID controllers to discrete systems control using equipment which is found in industry.

APPLICATIONS OF ADVANCED TECHNOLOGIES

James B. Olsen	MDR 8651554
Eric G. Hansen	FY86 $339,063
WICAT Education Institute	FY88 $ 9,982
Provo, UT	Life Sciences

"Interactive Video Technologies for Biology Assessment and Instruction"

This project will combine existing technologies in a way that is designed to make the testing of students' achievements in biology and life sciences precise and efficient. The technologies involved include the latest microcomputer, interactive videodisc and CD-ROM containing data bases of questions and instructional materials, graphics, shared disks and printers, and adaptive testing. The tools developed under the project are predicted to ease the administration and bookkeeping burdens associated with the creation, administration and scoring of high school science assessment and diagnostic tests and to provide test results with prescriptions to text-based curricula for remediation and enrichment. Diagnostic tests with automated routing to high quality videodisc-based instruction will also be provided. The prototype to be developed and tested focuses on biology and life sciences in grades 7-12. Once the concept is proven, WICAT is in a position to readily extend the system to high school courses in physics, chemistry and general science.

The main objective of this project is to test the validity of the adaptive testing approach in science to determine if it can yield time improvements of 50% to 70% as obtained in mathematics.

The independent evaluation is expected to show, in addition to decreased testing time, improved teacher-made tests and improved student attitudes toward science. Results will be disseminated through publications and at regional and national conferences of science teachers and school board members.

VERMONT

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Carolyn M. Silsby
Science
Montpelier High School
Montpelier, VT

William E. Baker
Mathematics
Lamoille Union High School
Hyde Park, VT

1988

Elizabeth A. Rainey
Mathematics
Shelburne Middle School
Shelburne, VT

William F. Romond
Science
Colchester High School
Colchester, VT

TEACHER ENHANCEMENT PROGRAM

Margaret G. Ottum	TPE 8751711
Andrea Bartlett	FY88 $273,371
Johnson State College	Geology
Johnson, VT	

"Project GEO: Earth Science in the Middle Grades"

Project GEO provides a support network, requisite concepts, and curriculum materials so that middle grade teachers from six rural northern Vermont communities will improve their teaching of earth science. The project addresses the special needs of this group of teachers, many of whom lack training in science and who, due to location, have limited opportunities for professional development.

Participating teachers will attend a graduate-level earth science/curriculum development workshop which will provide earth science concepts, hands-on activities, field trips, and instructional techniques. Participants will receive: (1) a general rock and mineral collection; (2) regionally-specific rock and mineral specimens; (3) local geologic and topographic maps and field trip guides; (4) field collecting equipment; (5) Earth Science Handbook; and (6) Curriculum Guide, all locally developed by the staff of the project.

Lecture, discussion, laboratory work, and field trips will be scheduled throughout the workshop. Principals will join teachers for the orientation and the first two days of instruction so that they will be familiar with the material covered. This involvement by principals should facilitate the curricular changes that will result as a consequence of this program and provide the administrative support for the development of a good earth science course complete with laboratory activities and field trips.

During the year following the course, teachers will receive three follow-up visits at their schools from the Project GEO Support Network. This Network consists of Johnson State College faculty in science and education, Vermont Department of Education, State Geologist's Office, Vermont Natural Resources Council, Vermont Geological Society, and the Vermont Institute of Natural Science. Reunion conferences in the winter and spring will allow participants to share their experiences and provide feedback.

COLLEGE SCIENCE INSTRUMENTATION

Frederick M. Wiseman USE 8853297
Johnson State College FY88 $58,393
Johnson, VT Computers

"A Computing Center for Undergraduate Science and Mathematics"

A computing facility has been established to support curricula in Mathematics and the sciences. The computing center's mission is the education of students in computed aided data analysis and presentation such as that they will encounter in the workplace and in graduate education. The close coupling of the graphics-based computing facility and a series of courses integrates in a unique way the viewpoint and intellectual ecumenism characteristic of small colleges with the data analysis and presentation rigor found in specialized programs.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

William Fingerhut USE 8750236
Lyndon State College FY87 $13,475
Lyndonville, VT Atmospheric

"Modernizing an Undergraduate Synoptic Meteorology Laboratory"

Lyndon State College will acquire modern computer work stations that analyze and display real-time weather data--radiosonde sounding, weather maps, and satellite pictures--for classroom instruction, operational forecasting and student projects. Each work station will consist of an IBM PC/AT personal computer, high resolution EGA color monitor, and appropriate computer upgrades (e.g. memory expansion, color graphics card, etc.), which will be consistent with meteorological data supplied by the University Corporation for Atmospheric Research through its Unidata program. These work stations will familiarize students with modern equipment and greatly improve their three-dimensional perception of atmospheric conditions. They will thus improve undergraduate education in meteorology, as well as weather data dissemination to the local community.

COLLEGE SCIENCE INSTRUMENTATION

Jeffrey H. Byers USE 8852661
Middlebury College FY88 $81,000
Middlebury, VT Physical Sciences

"Nuclear Magnetic Resonance Instruction for Undergraduates"

The nuclear magnetic resonance spectrometer system is used to introduce undergraduate Chemistry and Physics students to an important area of modern spectroscopy. The instrument is used in Introductory Organic Chemistry, Advanced Organic Chemistry, and Quantum Physics courses. This instrument is also used in a newly developed integrated laboratory course in Inorganic, Analytical, and Physical Chemistry. Students in the senior thesis programs in Chemistry and Physics utilize this instrument extensively, and thus gain instrumental experience with modern equipment similar to that they will encounter in industry or graduate school. This hands-on experience also enhances understanding of the theoretical concepts introduced in the lecture portion of the courses.

The grantee provides funds for this project that are an equal match for the NSF award.

TEACHER PREPARATION PROGRAM

Richard H. Dollase TPE 8850598
Middlebury College FY88 $49,953
Middlebury, VT Chemistry

"Creating Models for Excellence in Science and Mathematics Teaching"

A conference to stimulate science and mathematics faculty at outstanding liberal arts colleges to become actively involved in the scientific preparation of teachers by redesigning science and mathematics courses will be planned and convened by the Consortium for Excellence in Teacher Education (CETE) and Middlebury College, the home institution of the director of CETE. Membership in CETE is comprised of the following institutions: Brandeis University, Brown University, Connecticut College, Dartmouth College, Harvard University, Middlebury College, Mount Holyoke College, Princeton University, Smith College, Swarthmore College, University of Pennsylvania, Vassar College, Wellesley College, Wesleyan University, and Yale University. The conference will seek to produce collaboration among scientists, mathematicians, and educators in modernizing course content, incorporating recent educational research results, and in the case of science courses, providing hands-on experiences at CETE and 31 other liberal arts institutions located in the eastern half of the United States. Participants will also examine other components of teacher preparation programs and define the role that liberal arts institutions have in preparing mathematics and science teachers. A major report: Undergraduate Teacher Education and the Liberal Arts: Creating Models of Excellence will be published as a result of the conference. The conference should result in strengthening and deepening science and mathematics education at liberal arts colleges. Cost sharing by CETE and Middlebury College is 12.6%

COLLEGE SCIENCE INSTRUMENTATION

Stephen J. Ratcliff	USE 8750416
Middlebury College	FY87 $24,632
Middlebury, VT	Astronomy

"A Multi-Telescope Observatory for Undergraduate Astronomy"

A new astronomical observatory at Middlebury will provide undergraduate students at all levels with an outstanding experience in observational astronomy. A professional quality, computer- controlled 16-inch reflecting telescope will be used to introduce beginning astronomy students to planets, stars, and galaxies. More experienced students will use this telescope for photometry and photography in conjunction with astronomy courses, while undergraduate thesis students will use it for research projects studying variable stars or developing new instrumentation. Three new 8-inch telescopes will be used in lower-level astronomy courses to give students a far greater opportunity for observational work than has previously been possible. The new telescopes and associated instruments will enrich the entire astronomy curriculum at Middlebury College. In addition, the new observatory will become a community resource through public viewing nights and programs for students in elementary and secondary schools.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Katherine A. Stahl	MDR 8851093
Eve Pranis	FY88 $303,745
National Gardening Assoc	FY89 $367,197
Burlington, VT	FY90 $237,058
	Biology

"Grow Lab: Stimulating Science Inquiry in K-8 Classrooms"

The National Gardening Association will provide teachers with a familiar teaching medium, an indoor garden laboratory, to excite children about science inquiry. Through the special design of the Grow Lab, students will be able to quickly grow vegetables and flowers through full life cycles, from seed to seed, in the classroom. This curriculum encourages the integration of science with other subjects in each classroom day.

The purpose of Grow Lab is: 1) to establish and reinforce early in life that problem solving and scientific inquiry are fun, and not just for scientists; and 2) to teach a variety of science skills and concepts, not limited to plant science, using plants as the tool with which young children learn to make sense of their world. The National Gardening Association will develop, evaluate and disseminate three Grow Lab science activity guides for elementary and middle school. Activity kits, a teacher newsletter, a series of wall charts, a teacher training videotape, an extensive Grow Lab certified instructor program, and a national marketing plan in conjunction with Hubbard Scientific will also be completed.

COLLEGE SCIENCE INSTRUMENTATION

Alan J. Fillip	USE 8851451
Norwich University	FY88 $17,867
Northfield, VT	Environmental

"Environmental Monitoring Capability for Volatile Organic Compounds"

This project provides the Environmental Engineering Technology undergraduate curriculum at this institution with the laboratory capability to sample and analyze low concentrations of volatile organic compounds in air, water and soil. The state-of-the-art pollutant monitoring equipment which students use include: a flame ionization detector gas chromatograph, a thermal desorber unit, a photoionization detector, a volatile and semivolatile organic sampling train and personal and ambient air sampling devices. This equipment broadly enhances the spectrum of instruments students can use in their Air Pollution, Water Chemistry and Hazardous Waste laboratory courses and allows them hands-on experiences in the methods and equipment they are most likely to use early in their professional careers.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Gregory D. Wight	USE 8750154
Norwich University	FY87 $9,160
Northfield, VT	Environmental

"An Undergraduate Environmental Monitoring Laboratory Data Acquisition System"

The objective of this project is to upgrade the environmental monitoring laboratories with the addition of computer controlled data acquisition and statistical analysis. This upgrade will result in laboratory experiences for the student which are more in agreement with current practice in industry and the regulatory agencies. Two laboratories will be upgraded-the Air Pollution Laboratory and the Water Chemistry Laboratory. Extensive instrumentation already exists, and the added computer equipment will facilitate the introduction of statistical analysis to the laboratory exercises and supplement a recently added course in mathematical statistics.

VIRGINIA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Rebecca R. Dewey
Science
Falls Church High School
Falls Church, VA

Panayiotis Pittas
Mathematics
Heritage High School
Lynchburg, VA

1988

Patricia A. Reisdorf
Mathematics
Foxcroft School
Middleburg, VA

Patricia Allen Rourke
Science
St Agnes Episcopal School
Alexandria, VA

NETWORKS PROGRAM

Andrew J. Verdon, Jr.	TPE 8751777
Ronald E. Armstrong	FY87 $5,000
American Geological Institute	Geology
Alexandria, VA	

"Working Conference on Earth Science Education"

The purpose of the Working Conference is to have leaders in the different fields of the earth sciences and earth science education develop a structure by which a network of experts in the earth sciences and education communities can address unresolved issues in earth science education. The Working Conference is a necessary extension of the 1985 Conference and the 1986 Task Force meetings. Future improvements in teacher preparation and state certification requirements, in-service instruction, curriculum development, and instructional research in earth science education depend on the resolution of these major issues in earth science education.

NETWORKS PROGRAM

Andrew J. Verdon, Jr. TPE 8850519
Marvin E. Kauffman FY88 $9,950
American Geological Institute Geology
Alexandria, VA

"Conference of Eminent Earth Scientists and Educators for the Planning of a K-12 Earth Science Education Framework"

The goal of this conference is to develop a K-12 Earth Science Education Framework. Approximately twenty geoscientists representing NASA, NOAA, USGS, and NSF-Geoscience research programs, twenty earth science teachers, and several specialists in earth science education will take part in a five-day conference to undertake this task. A pre-conference paper will be prepared by each scientist delineating the major concepts of Planet Earth within their field of expertise. During small group sessions at the conference, teachers will work with scientists to identify those concepts that are important for all students and those that should only be introduced to students desiring to pursue a career in one of the sciences. This award will only cover about ten percent of the cost of this conference. The major cost of the conference will be funded by other government agencies, publishing companies, school systems, and the American Geological Institute.

COLLEGE SCIENCE INSTRUMENTATION

Raouf L. Selim USE 8750149
Christopher Newport College FY87 $14,675
Newport News, VA Physics

"A Low Temperature Thermal Measurement System for Undergraduate Students"

The Department of Physics at Christopher Newport College will establish a laboratory for the measurement of the thermal properties of materials at low temperatures. The aim of the project is twofold. It will provide industrial-quality equipment with which seniors can design the system, giving them critical experience with the principles taught in their digital electronics courses. Furthermore, by using this system, students will investigate experimentally the low temperature phenomena that they have studied in their fundamental courses in thermodynamics, modern physics and solid state. The requested equipment includes a temperature controller, digital meters and current sources, and a diffusion pump. The equipment will be used in conjunction with a closed-cycle helium refrigerator the department already owns. With the automated system students will measure resistivity and specific heat in the temperature range of 10-300 Kelvin.

NETWORKS PROGRAM

Jack A. Gerlovich TPE 8751505
Council State Sci Supervisors FY88 $111,180
Richmond, VA Networking

"A National Computer Conferencing Network for Science Education: PSI-NET"

With previous NSF funding and support from IBM, an electronic network, PSI-NET, has been established. The network links all state science supervisors and is accessible by the NSF, NSTA, and other organizations concerned with school science education. This system will now be extended to science teachers in six states to test the technical feasibility and the utility of this further networking through a single system. IBM will continue to support the development of the system technically. A committee of state science supervisors will guide and evaluate the use of the system in the six trial states to provide a basis for deciding on the desirability of extending the network to science teachers in all states. Introduction of state mathematics supervisors onto PSI-NET will also be initiated to evaluate the utility of this additional extension.

Cost sharing by the partners will total 159% of the NSF funding.

YOUNG SCHOLARS

Robert M. McCombs RCD 8850177
Jeane J. Dughi FY88 $42,340
Sarah J. Ward-Petroske FY89 $42,342
Joseph E. Browne Life Sciences
Arthur J. Butt
Eastern Virginia Medical Authority
Norfolk, VA

"Young Scholars Program"

In 1986, the Eastern Virginia Medical School and the Norfolk Public School System initiated a Magnet High School for the Health Professions, targeted toward minority students. The Young Scholars Program adds a logical and important dimension to the program by introducing the students to career opportunities in the sciences as well as emphasizing the ethics of science and scientific method in small group problem solving conferences. The students participate in research projects in the life sciences under the direction of EVMS faculty. These research projects, initiated during the summer phase, continue through the academic year. Students continue their research laboratory experience during all three years of the Magnet High School Program.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Stephen L. Rabin	MDR 8851076
Mary E. Key	FY88 $400,414
Educational Film Center	FY89 $188,379
Annandale, VA	Chemistry

"The World of Chemistry Secondary School Project"

The World of Chemistry Secondary School Project (WCSS) is a distinctive, cost-effective, educational package for use as supplementary materials for secondary schools, based upon materials developed for a college-level course which was principally funded by the Annenberg/CPB project. The materials will include a set of 20 modules on chemistry, which can be used for basic to honors-level first chemistry courses. Each module will comprise a 15-minute video tape with accompanying written materials of a maximum of five pages per module. The written materials will be published as a loose leaf Instructional Manual to provide for easy duplication. Each video module will illustrate and highlight a given concept or idea in a multi-faceted way: at the molecular level with two and three dimensional graphics and state-of-the-art animation; at the macro level through laboratory demonstrations and suggested in-class activities for students; at the very broad macro level through industrial applications and practical problem solving by scientists and engineers; and at another macro level through relating concepts to everyday life, such as bio-medical applications, food preparation, and the environment.

High school chemistry courses have long been in need of revisions and revitalization. In addition, many schools have severely curtailed laboratory experiments due to financial and liability issues. These materials will address both problems by providing excellent supplementary and current information in the area of chemistry. Where laboratory activities are minimal to nonexistent, the portrayal of experiments and practical applications will help fill a serious gap. The developmental process is being modeled on a proven process used by the successful project, Adaptations of the Mechanical Universe and Beyond.

COLLEGE SCIENCE INSTRUMENTATION

Herbert J. Sipe, Jr.	USE 8750395
Hampden-Sydney College	FY87 $10,550
Hampden Sydney, VA	Chemistry

"Atomic Absorption Spectrometry for a Project-Based Laboratory Program"

Modern atomic absorption spectrometric (AAS) techniques are being incorporated into the project-based laboratory program in the Chemistry Department at Hampden-Sydney College, through the recent acquisition of a computer-controlled atomic absorption system. The addition of this instrumentation to current holdings, and its instructional use, further encourages attitudes of resourcefulness and independence in undergraduate students who can now profit fully from the spectrum of scientific instrumentation available. Realistic laboratory experiences are provided, beginning in the freshman and sophomore years and continuing with increasing sophistication to activities in the research-style junior/senior advanced laboratories.

TEACHER PREPARATION PROGRAM

Dianne Robinson	TPE 8652086
Robert D. Bonner	FY86 $126,846
Hampton University	FY87 $135,839
Hampton, VA	FY88 $134,579
	FY89 $107,920
	FY90 $ 96,545
	MidSch Science

"Model Program for the Preparation of Middle School Science Teachers"

Hampton University will develop a five-year model program for the preparation of middle school science teachers. This model program will involve the development of one new mathematics course, three new science courses, and the modification of six existing science courses in the first three years. Year four and five will focus on course evaluation and revision, selection of mentor teaches, development of field placement, and student teacher experiences. The science content requirements being proposed satisfies NSTA recommendations for middle school teachers.

In an attempt to recruit minority students into teaching, Hampton University, which has a predominately black student body, will work closely with high school science teachers and will mount a powerful recruitment campaign within its student body. It is projected that within five years more than 108 students will be enrolled in the middle school science teaching program.

This project represents a cooperative effort among the academic departments of science education, biology, chemistry, physics, and computer science. Faculty from each department will be involved in course development and evaluation. Public school personnel will also be involved as members of an advisory committee, as mentor teachers, and in the planning and implementation of in-school preservice teaching experiences.

COLLEGE SCIENCE INSTRUMENTATION

Sandra Boatman USE 8750380
Hollins College FY87 $7,160
Hollins College, VA Biology

"Electrophoretic Equipment for Improving Undergraduate Biology and Chemistry Programs"

Electrophoretic equipment is being used to improve undergraduate Biology and Chemistry laboratories associated with courses in Biochemistry, Molecular Genetics and with the Undergraduate Research program. Among the major new instruments acquired through this award are vertical and horizontal slab gel and transfer electrophoretic apparati (with their respective power supplies), a scanning densitometer, transilluminator and photodocumentation equipment. Their purchase is making it possible for the undergraduate women in these classes to gain experience with techniques that are central to modern Biology, Biochemistry and Molecular Biology, and for the College to continue to provide instruction and research experience at a high experimental level.

FACULTY ENHANCEMENT

Benjamin A. DeGraff USE 8854235
James Madison University FY88 $18,051
Harrisonburg, VA Chemistry

"Chemical Applications of Lasers Workshop"

James Madison University will offer a week-long workshop for college and university faculty. The workshop will focus on lasers and their application to solving chemical problems. The offering will consist of a one week intensive exposure to both the theory and practical application of laser technology to areas of interest to all branches of chemistry. The course will include (1) lectures on the fundamentals of lasers and related topics, (2) laboratory experiments to illustrate the principles presented in lectures, (3) lectures and laboratory experiments dealing with current applications of lasers to chemically interesting problems, and (4) an opportunity to engage in a special project of interest to the participant, the technology of which will be transportable to the participant's home institution. A major feature of this workshop is to provide exposure to laser technology at a level appropriate for incorporation at the undergraduate level.

In addition to the NSF funds, participants' institutions will provide about 25% in travel expenses.

COLLEGE SCIENCE INSTRUMENTATION

Daniel M. Downey USE 8750124
James Madison University FY87 $19,992
Harrisonburg, VA Chemistry

"Experimental Nuclear Chemistry in the Undergraduate Curriculum"

Equipment needed to implement a course in nuclear chemistry has been recently acquired by the Chemistry Department at James Madison University. An alpha spectrometer, a gamma spectrometer, and an analyzer system were among the items included. The availability of this system provides chemistry majors (and minors), pre-medical, and pre-engineering students with training in modern nuclear measuring techniques involving pulse height measurements for alpha and gamma particle spectrometry. Along with teaching basic concepts, the use of nuclear counting equipment for neutron activation analysis, environmental monitoring, medical applications and selected applications of technical and social merit is included.

COLLEGE SCIENCE INSTRUMENTATION

Glen C. Gustafson USE 8851274
James Madison University FY88 $24,308
Harrisonburg, VA Geography

"Modernizing the Geography Laboratory Experience with ERDAS"

This project provides for purchase of an 80386-based computer workstation, ERDAS satellite imaging hardware and software, and associated computer peripherals. This equipment will be used to improve instruction in lower- and upper-division Geography courses. Students will be trained in the use of modern digital imaging techniques in remote sensing. In addition, advanced undergraduate students will use the equipment for special projects.

The grantee will match the NSF equipment award with an equal amount of funds, and will provide additional support for faculty training.

COLLEGE SCIENCE INSTRUMENTATION

Gerald R. Taylor, Jr. USE 8851396
James Madison University FY88 $11,600
Harrisonburg, VA Physics

"Computer Interfacing for Advanced Undergraduate Physics Laboratories"

The grantee will purchase two microcomputer-based control and data acquisition systems, a digital picoammeter, two autoranging digital multimeters, and a bipolar power supply/amplifier. This equipment will be used to improve instruction in upper-division Physics Laboratory courses, and by advanced undergraduates in independent research projects. Students will use these instruments to control and analyze data from selected modern Physics experiments and in some newly developed plasma physics experiments.

The grantee will match the NSF award with an equal amount of funds.

YOUNG SCHOLARS

Edward C. Keller, Jr.	RCD 8850019
Marine Science Consortium	FY88 $82,037
Wallops Island, VA	FY88 $82,037
	Life Sciences

"Pre-College Marine Science for Young Hearing Impaired Students"

This residential project is designed to expose outstanding young precollege hearing impaired students (in grades 8 and 9) to the interdisciplinary study of Marine Science. Thirty hearing-impaired students are given a four-week educational program involving lecture, hands-on field, laboratory, and research experiences. The program is located at the Wallops Island Marine Science Consortium at Wallops Island, Va.

COLLEGE SCIENCE INSTRUMENTATION

Elizabeth M. Hairfield	USE 8851924
Mary Baldwin College	FY88 $31,250
Staunton, VA	Chemistry

"Enhancement of the Curriculum through GC-MS"

A Hewlett-Packard 5890A/5870B gas chromatograph with a mass selective detector, including ion gauge, data system and software is being utilized in this project. Nearly 80% of the student research in Chemistry, Biology and Psychology is being facilitated, with at least 60% of the science majors learning the principles and some applications of this important analytical method. The young women are being better prepared to enter graduate school and the work force in science. Significant student research is being produced and disseminated through presentations at professional meetings and in the appropriate technical journals.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Rosemary Hubbard	USE 8852723
Marymount College of Virginia	FY88 $11,407
Arlington, VA	Biology

"Computer-Interfaced Physiology Equipment for an Undergraduate Teaching Laboratory"

This project is part of an overall plan to improve laboratory instruction in the Biological Sciences through the introduction of modern computer-interfaced equipment. The plan develops the following areas: (1) the introduction of more quantitative physiological experiments, (2) the improvement of instruction involving computers, (3) the application of the computer to data gathering and analysis and to simulating scientific phenomena, and (4) the introduction of student research. The course which accrues the greatest benefit from these developments is Anatomy and Physiology. However, the equipment requested is being utilized in all Biology courses where appropriate.

Because this college enrolls women primarily and because these women in science pursue careers in medicine, teaching, nursing and research, the main benefit of these modern instruments is to provide women with stronger qualifications for continuing graduate studies or for entering science-based careers.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Steve R. Hampton	USE 8750681
Mary Washington College	FY87 $9,365
Fredericksburg, VA	Psychology

"Broadening Opportunities for Undergraduate Laboratory Research in Psychology"

The psychology students will be provided with exposure to a variety of basic scientific laboratory situations involved in the experimental study of behavior. A computerized biofeedback system designed to measure human physiological responses (skin resistance, muscle activity, heart rate and brain waves) is providing students with the opportunity to study experimentally and clinically significant phenomena such as conditioning, emotionality, stress, anxiety and the effects of therapeutic interventions such as biofeedback. Additionally, four custom circuit cards, complete with interface relays and switches, are being used in conjunction with the microcomputers and other hardware. The devices are designed specifically for the psychology laboratory and are facilitating the integration of the microcomputers into the undergraduate laboratory courses. Such integration provides students with first hand experience in using computers to control experiments and record and store data. The equipment is also being used in support of undergraduate student research projects.

YOUNG SCHOLARS

William C. Allgyer	RCD 8850294
William S. Harris	FY88 $20,714
Mountain Empire Comm College	FY89 $20,714
Big Stone Gap, VA	Mathematics

"Magnet School Strengthening Grant"

This program is part of the Virginia Governor's School Program, which offers students enrichment activities beyond those available in the regular school programs. Mountain Empire Community College Young Scholars Program strengthens its current summer enrichment program in math and science for high school juniors and seniors.

Referred to locally as the Magnet School, this four week program features hands-on scientific and mathematical investigation, including overnight field trips to science-related facilities and locations. Real-world environmental and ecological problems are studied and innovative teaching methods are utilized. Students are selected from the seventeen high schools in the College's service area. High School teachers also participate in the summer program. They are exposed to non-traditional instructional methodologies, update their knowledge in the fields of science and mathematics and contribute to improved communications and cooperation between the high schools and the College.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

James D. Gates	MDR 8751432
National Council of Teachers of Mathematics	FY87 $61,848
	FY88 $ 2,000
Reston, VA	Mathematics

"Dissemination of Information from Sixth International Congress of Mathematical Education"

The International Congress on Mathematical Education (ICME) is the most important forum for exchanges of scientific information among scholars in mathematics education. The Sixth ICME will be held on July 17 - August 3, 1988 in Budapest, Hungary. Given the current crises in mathematics education, it is essential that the United States be well represented by key mathematics educators and that information about the Congress be widely disseminated among our nation's mathematics educators and educational leaders. The National Council of Teachers of Mathematics (NCTM), with the support of the Mathematical Association of America (MAA), will select 40 delegates to ICME-6 whose travel will be partially subsidized and who will submit a written summary of the Congress activities. Those reports along with invited papers by selected individuals will serve as a basis for a monograph on Congress activities that will be published by NCTM. Articles will be prepared by the Awards Committee to be submitted for publication in NCTM and MAA newsletters and journals with a combined circulation of nearly 70,000. Presentations on Congress proceeding will be arranged at various NCTM meetings.

The necessity to gain mathematics education on a global basis cannot be too strongly emphasized. Problems in education appear to be more universal than previously thought. The sharing of solutions among nations is vital if we are to develop the most effective cures in mathematics education. Attendance at this Congress by mathematics educators from the United States and subsequent publications will provide invaluable information to those persons concerned with the current state of education in mathematics, an area of significance in future political and economic areas.

STUDIES AND ANALYSES

Mary M. Lindquist	OSPA 8652477
Catherine A. Brown	FY87 $122,772
Thomas P. Carpenter	Studies
Edward A. Silver	
Jane O. Swafford	
National Council of Teachers of Mathematics	
Reston, VA	

"NCTM Interpretative Reports of the Fourth NAEP Mathematics Assessment"

The National Council of Teachers of Mathematics (NCTM) has been responsible for the interpretation and dissemination of the results from the first three national mathematics assessments conducted by the National Assessment of Educational Progress (NAEP). This project calls for interpretation and dissemination of the fourth mathematics NAEP assessment by a NCTM committee. This effort is prompted by the following considerations. (1) The majority of the extant interpretative reports were based on the second assessment and are out of date. (2) New types of data and new trend analyses are available. There is currently a critical need for a careful interpretation of these data to inform an NCTM project in setting standards for K-12 mathematics curriculum and instruction.

Based on an in depth analyses of the raw NAEP data, a detailed profile of students' performance in mathematics and a description of school and instructional variables which could influence this performance will be prepared. In addition, the trend analyses over the four assessments will be interpreted. Through reports and presentations, these findings will be disseminated to a wide audience including classroom teachers, administrators, teacher educators, researchers, and the general public.

Donald G. Weinert	RCD 8803021
National Society of Professional Engineers	FY88 $100,000
Alexandria, VA	Engineering

"National High School Engineering Design Competition"

The proposed National Engineering Design Competition (NEDC) is a pilot project providing an engineering design experience for high school students working in teams. The purpose of this activity is to encourage and support students who are interested in pursuing careers in engineering, technology, science, and mathematics.

State and local level competitions will be held and will focus on the application of science to real problems. Professional engineers will provide mentoring, using tutorial seminars, for teachers and students. The competition will provide information and an experience to help the student gain a better understanding and appreciation for engineering.

This project is co-funded with the NSF Directorate for Engineering.

CAREER ACCESS OPPORTUNITIES

Jesse C. Lewis	USE 8850624
Larry Mattix	FY88 $103,891
Jacob Becher	FY89 $100,000
Robert D. Bonner	Minority Center
Lillian B. Myers	
Norfolk State University	
Norfolk, VA	

"Minorities Institute for Regional Access to Careers Leading to Engineering and Science (MIRACLES)"

This prototype project includes, in the first year of operation, several activities to strengthen minority education at the precollege level. It was cooperatively developed by Norfolk State University, Hampton University, Old Dominion University, and the Cooperative Hampton Roads Organizations for Minorities in Engineering (CHROME), a non-profit planning, coordinating, and advocacy organization of higher education institutions, government agencies, public school systems, business and industry, and civic and professional associations. During the first year, a set of activities, based on science and mathematics experiences, and designed to nurture, encourage and motivate minority students are being implemented. These include Saturday Academies of Science, held at Norfolk State University, Hampton University, and Old Dominion University, for seventh and eighth grade students conducted on six successive Saturdays in the fall and repeated again in the spring. Forty students are involved in each Academy, for a total enrollment of 240. Parents are especially urged to attend the orientation session at each Academy. Topics in mathematics, physical sciences and the life sciences are covered and activities are designed in a participatory mode. The culmination of Academy activities will be a region-wide science fair to be held at Norfolk State University. A series of three colloquia designed for precollege teachers, to complement the Saturday Academies, are being held- one on each campus for 40-60 precollege teachers. The colloquia are sequential in nature with themes of: Sensitizing Educators to Phobias in Science; Innovative Concepts to Promote Interest in Science; and, Future Implications for Science. Plans for the second year and beyond will expand the activities to include the undergraduate level.

COLLEGE SCIENCE INSTRUMENTATION

Walter Wimbush	USE 8851740
No. Virginia Comm College	FY88 $10,780
Alexandria, VA	Physics

"Microcomputer as a Learning Tool in the Undergraduate Physics Laboratory "

The use of a computer as a laboratory instrument is fast becoming a standard within the undergraduate Physics laboratory. It is important, however, that the computer not be used to merely mechanize data gathering and analysis, virtually replacing the student in the lab and leaving him as a passive agent. This project will develop innovative ways to use the computer to allow the student to have a deeper intellectual experience in the lab. Using commercially available computer interfaces, the students will be instructed in the use of the computer hardware and software. They will then be encouraged to devise variations of standard undergraduate Physics labs using the computer to acquire the data and then to analyze the data.

The computers will be interfaced with airtracks and photo-reflective sensors, as well as existing transducers and sensors.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Jacob Becher	TPE 8751746
R.Lee Kernell	FY88 $437,706
Ian D. Howard	Elem Science
Old Dominion University	
Norfolk, VA	

"Regional Institute for Teachers of Science in Grades 4, 5, and 6 in Tidewater Virginia"

Regional Institute for Teachers of Science in Grades 4, 5, and 6 in Tidewater Virginia is a three-year sequential program to upgrade the qualifications of 40 upper elementary grade science teachers in six cooperating school districts in the Tidewater area. In the first two years of the program there is a strong emphasis on improving the physical science background and teaching skills for the participants. This is done through two six-week summer workshops with follow-up academic year seminars. In the third year of the program 35 of the teachers will be selected to participate in a six-week leadership program designed to permit them to provide in-service training to other elementary school teachers within the Tidewater area.

This program will serve an area with a high minority teacher and student population. Approximately 65% of the participating teachers will be from minority groups, and approximately 90% of the participants will be female. The program includes a very strong evaluation component which will seek to measure the effect of the program on students as well as teachers. The participant teachers will assist in the design and implementation of evaluation instruments. Likewise, the participating school districts have agreed to implement in-service support following the completion of the project.

YOUNG SCHOLARS

R.Lee Kernell	RCD 8850137
Jacob Becher	FY88 $35,735
Janis V. Sanchez-Hucles	FY89 $35,735
Old Dominion University	Physics
Norfolk, VA	

"Exploration of Careers in Applied Physics and Engineering for Students in Grades 9, 10, and 11"

A science career awareness institute at Old Dominion University offers motivated students in grades 9, 10, and 11 the opportunity to explore a variety of careers involving applications of physics. Emphasis is placed on careers in applied physics, engineering (civil, electrical and mechanical), physical oceanography, chemistry, astronomy, computer science and mathematics, and science education. This four-week summer residential program: (1) provides classroom enrichment experiences to enhance the knowledge of participants in applied physics and (2) fosters meaningful interactions between participants and practitioners in the areas of applied physics through lab activities and group discussions. Women and minorities that are underrepresented in science have the opportunity to interact with role models who are scientists and engineers. This project enhances participant appreciation for science, provides guidance in career planning, and helps participants assess their potential for success in fields involving applications of physics.

COLLEGE SCIENCE INSTRUMENTATION

Billie J. Farrier	USE 8851763
Radford University	FY88 $18,035
Radford, VA	Chemistry

"Fourier Transform Infrared Spectroscopy in the Undergraduate Laboratory"

A Fourier Transform Infrared Spectrometer is being purchased for use by the undergraduate students as a part of their educational program. This instrumental technique is widely used in both industrial and educational applications. The Fourier transform technique with its computer interface provides a method for analyzing a wider range of samples with a greater sensitivity than is possible with ordinary infrared instruments. Prior to the purchase of this instrument, the students could not become proficient in this technique. The teaching/research sensitive instrument that is being acquired is enhancing the laboratory experience of the students.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Eugene V. Gourley	USE 8750261
Radford University	FY87 $25,500
Radford, VA	Biology

"Environmental Chambers to Improve the Undergraduate Biology Curriculum"

A controlled-environmental room with two chambers procured with assistance from this award is enabling Biology students to develop a better understanding of experimental design. The laboratories in which these new facilities are being used are designed to give the students hands-on experience in manipulating environmental variables. This provides them with a better understanding of the effects of the various environmental factors on the physiology and behavior of organisms, as well as helping them to improve their investigative skills. Courses to which these chambers are contributing fresh opportunities for student originality and creativity include Animal Physiology, Plant

Physiology, General Ecology and Vertebrate Zoology, as well as Independent Research. Since the school is located in the Appalachian Mountains, numerous local mountain species of fish, amphibians, reptiles and small mammals will be employed in these studies.

COLLEGE SCIENCE INSTRUMENTATION

Bernd H. Kuennecke USE 8750086
Radford University FY87 $50,000
Radford, VA Geology

"Automated Land Resources Inventory and Analysis System"

Radford University will purchase an automated land resources inventory and analysis system and field surveying equipment. The data acquisition, data analysis, and geographic information systems with their peripheral hardware and software components will be used by undergraduate students at Radford University as part of their educational program. These inventory and analysis systems are used by scientists in many fields (geography, remote sensing, urban and regional planning, environmental protection, civil engineering, transportation planning, etc.) and are now being employed by private firms, governmental agencies, academic research institutions, and educational institutions.

COLLEGE SCIENCE INSTRUMENTATION

George F. Spagna, Jr. USE 8750772
Randolph-Macon College FY87 $7,536
Ashland, VA Astronomy

"Introductory Astronomy Laboratory Upgrade"

The Randolph-Macon physics department will improve the laboratory component of its Introductory Astronomy offering by unifying the experience around a central theme. The purchase of key items of laboratory and observatory equipment will focus the educational task on the range of observing tools and techniques available in modern visible- light astronomy. Experiments in photography, spectroscopy, and photometry will be offered. Each method will be studied in an indoor laboratory setting to provide sufficient skill development prior to applying the techniques in the college observatory. The project will add laboratory spectrometers, a telescope-mounted photometer, and a computer for instrument control to the equipment already available.

COLLEGE SCIENCE INSTRUMENTATION

Lucien T. Winegar USE 8750408
Randolph-Macon College FY87 $12,564
Ashland, VA Psychology

"Statistical Computing in Undergraduate Psychology"

The integration of statistical computing into the psychology curriculum is providing substantial improvement in the quality of instruction in statistics and methodology, and an increase in the quality and quantity of research being conducted by the psychology majors. A microcomputer laboratory is being established for statistical computing to be used predominately in three research courses designed as part of a recent curricular revision. The activities are increasing the student's understanding of science, and are contributing to the preparation of scientists and policy-makers who have a more sophisticated appreciation of the research process.

COLLEGE SCIENCE INSTRUMENTATION

Dennis M. Goff USE 8750734
Randolph-Macon Woman's College FY87 $20,008
Lynchburg, VA Psychology

"Development of Physiological Psychology and Psychophysiology Laboratory Facilities"

The purpose of this project is to develop facilities which give undergraduates experience with a range of laboratory procedures that are currently unavailable. This project is part of a more comprehensive adjustment in the psychology department's curriculum which will reestablish an emphasis on laboratory experiences. The laboratory in physiological psychology is providing experience with both traditional methodologies and psychophysiological methodologies. A laboratory course in developmental psychobiology is being added to the curriculum to take advantage of the improved animal facilities. The equipment is being used to upgrade the laboratory in introduction to psychology and is available for senior students to use in their independent projects.

INFORMAL SCIENCE EDUCATION

William U. Walton MDR 8652301
Patricia A. McNamara FY87 $468,945
Science Museum of Virginia Museums
Richmond, VA

"Common Sense/Science Sense: An Exhibit in the Physical Sciences"

The Science Museum of Virginia proposes to develop a 4,000 square foot exhibition, Common Sense/Science Sense that will explore visitors' pre-existing conceptions of the physical world from the perspective of recent research in cognitive science. Using the subject areas of Light and Seeing, Force and Motion, Waves and Patterns, and Matter and Molecules, the museum will research common misconceptions of scientific principles that are barriers to learning before developing more than 45 exhibit modules that address these naive views by encouraging visitors to first explore and then modify their own conceptions in ways that lead to more powerful and effective explanations of physical phenomena.

Research into museum visitors' existing preconceptions will be combined with formative evaluation of exhibit unit prototypes to insure that the resulting exhibits are effective. Collateral educational materials will be developed, and project results will be widely disseminated through research and professional communications, publications, and a conference for museum professionals.

The Science Museum of Virginia has an excellent professional staff with extensive experience in educational materials development and exhibition design. The museum has been a leader in the use of formative evaluation in exhibition development, and an educational research evaluation specialist on the museum staff is co-PI on this project.

This is an innovative project that will explore the application of significant new work in cognitive science to informal science learning in museums. Beyond the 350,000 annual museum visitors that will benefit directly, the results of this project will be of great interest and of potentially widespread influence in the design of educational exhibitions.

CAREER ACCESS OPPORTUNITIES

John J. Cavan	USE 8850607
Southside Virginia Comm College	FY88 $90,105
Alberta, VA	Minority Center

"Development of the Southside Virginia Community College Minority Opportunity Center for Science and Mathematics"

This model project is designed to encourage precollege minority students (Grades 8-12) to consider careers in science and mathematics teaching at the precollege level. Activities being implemented include identifying minority students in their junior and senior years, who show interest in and promise of becoming teachers, and who show potential for attending college; encouraging the graduating seniors among them to attend summer school at Southside Virginia Community College (SVCC) to make up as many deficiencies as possible--those seniors can then enroll in the full university parallel curriculum at SVCC in the fall semester. Those juniors identified by the same criteria may make up their deficiencies during the summer and throughout the academic year at SVCC. A special counseling process will also be initiated for them, including a minority mentor/advisor from the school faculty. In addition, minority students with an interest in and potential for becoming teachers are being identified in grades 8- 10, and a guidance staff person will be assigned to each student to develop an appropriate high school course plan. During the first year of the project, the Center Director and appropriate SVCC personnel work closely with Longwood College and Virginia Commonwealth University (VCU) to develop an articulation transfer agreement from SVCC to those institutions. Upon completion of their in-residence requirements for a teaching credential, students are placed in schools within their county of residence for student teaching. Students who successfully complete the teaching program at either Longwood College or VCU will be given priority consideration for positions available in their resident county.

COLLEGE SCIENCE INSTRUMENTATION

Joanne Rosinski	USE 8852144
Sweet Briar College	FY88 $8,400
Sweet Briar, VA	Biology

"Equipment for Undergraduate Plant Cell and Tissue Culture Laboratories"

With equipment procured through this project, new laboratory exercises using plant cell and tissue culture are being introduced into courses in Botany and Cell Biology. These exercises expose students to an important area of the plant sciences which currently is making significant contributions to the field of Biotechnology. Students use techniques such as phase and fluorescence microscopy to follow the stages of development as isolated, individual plant cells are induced to produce new tissue, and eventually to give rise to whole new plants. This process vividly demonstrates to students the excitement of working with plant systems and stimulates interest in further work in the plant sciences -- an area into which additional women need to be recruited.

The project holds promise for developing into a model that could be adopted widely in other institutions. The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

Charles D. Little	TPE 8517816
University of Virginia	FY86 $74,000
Charlottesville, VA	FY87 $71,000
	FY88 $81,420
	Biology

"Cell Surface: Extracellular Matrix Interactions During Development"

The supplementary funds requested will be used to support a high school science teacher in his lab for two summer months. The teacher will be given training in, and expected to make use of, several of the current techniques in use in the lab, including SDS-polyacrylamide gel electrophoresis, immunochemical techniques, embryo staging and dissection, and light microscopy. He will participate in the ongoing work of the lab in the preparation of antibodies to cell surface receptors for extracellular glycoproteins. He will also carry out an independent project purifying chicken laminin.

The high school teacher will experience research first hand in a productive lab working on the basic biology of heart development.

This project is co-funded with the NSF Directorate for Biological and Behavioral Sciences.

TEACHER ENHANCEMENT PROGRAM

R. Bruce Martin	TPE 8751252
Bascom S. Deaver, Jr.	FY87 $121,840
University of Virginia	Physics
Charlottesville, VA	

"University of Virginia High School Physics Teachers' Institute"

This Teacher Enhancement project will increase the content background and teaching skills of 48 precollege physics teachers in Virginia through a three week summer workshop held at the University of Virginia in each of the next two years. A representative sample of the target population was intimately involved in the development and design of the workshop. The workshop content will emphasize modern topics in physics and the use of the computer as an instructional tool.

The workshop staff will provide academic year follow-up in the classrooms of the participating teachers and through one or more formal group meetings during the academic year. A resource book of inexpensive physics demonstrations suitable for the high school classroom will be another outcome of the workshop. School districts of participating teachers will assure funds to provide the materials and equipment necessary for the teachers to implement the new topics in their physics instruction.

The excellent needs assessment, the commitment of the school districts, the servicing of a distinct area of need, the relationship of the project to other related initiatives in the state of Virginia, and the extensive follow-up during the academic year by the staff are positive features of this project.

INFORMAL SCIENCE EDUCATION

Barry W. Fox	MDR 8651632
William Christy	FY87 $60,676
Susan Gilley	FY88 $49,423
Michael Clifford	FY89 $27,751
Joseph Hoffenberger	Marine Science
Virginia Cooperative Extension Service	
Petersburg, VA	

"Four-H Marine and Aquatic Education Programs"

The 4-H organization of Virginia is developing a Marine and Aquatic Education Program with a strong field study component for youngsters ages five through nine. They plan to reach these young people through local and community 4-H clubs and in summer camps. One part of the program is aimed at the handicapped and development of strategies to meet their special needs. Other components of the program include volunteer training of high school students and adult leaders and a series of publications with emphasis on "hands-on" activities. There is a strong national dissemination plan and, through a national survey, the Virginia 4-H have determined that 27 state 4-H organizations are interested in adapting this program.

The 4-H organization is the largest youth organization in the United States with a membership of 4.3 million young people. They have a strong network, both urban and rural, with minorities representing 22% of the membership, 53% are female and 63% are under 11 years of age. The Virginia 4-H mirrors the national picture but with a slightly more rural membership.

This project provides an opportunity to strengthen science learning outside of the formal education system by supporting a test project in marine education. Over the next three years the project will be tested with 38,500 youngsters and 500 adults. The program will then be expanded to all 115,467 Virginia members as well as a strong outreach effort to the national membership.

TEACHER ENHANCEMENT PROGRAM

D. Rae Carpenter, Jr.	TPE 8470455
Virginia Military Institute	FY85 $192,603
Lexington, VA	FY87 $ 77,077
	Physics

"Honors Workshop - Demonstrations for Physics and Math"

Virginia Military Institute (VMI) will conduct a three-week workshop to honor and enrich outstanding high school physics teachers in grades 10-12 throughout the United States. Selection of participants will be made by the Committee on Physics in High Schools of the American Association of Physics Teachers. Selection criteria include teaching effectiveness and enthusiasm, interest in dissemination, and in motivating students in science as evidenced by leadership of workshops, publication, presentation of papers and other participation in professional societies, and activities within the school division.

Patterned after VMI's nationally known physics demonstration course, sessions will include seeing and producing new classroom demonstrations, subject matter enrichment with more complex demonstrations, sharing demonstrations with other invitees, and participating in science olympics and skills building activities. Mathematical concepts basic to physics will be introduced via demonstrations.

By identifying two or more master teachers from a state able to communicate the new techniques upon their return home, a nucleus of resource persons will be initiated which will disseminate the techniques of physics demonstrations as an exciting way of teaching secondary students.

COLLEGE SCIENCE INSTRUMENTATION

Daniel Y. Pharr	USE 8851885
Virginia Military Institute	FY88 $10,650
Lexington, VA	Chemistry

"Fourier Transform Infrared for Chemistry"

Fourier Transform Infrared (FTIR) Spectroscopy is being introduced into the undergraduate curriculum. The use of an FTIR affects more laboratory courses than any other instrument that could be purchased by the department. In General Chemistry the students are being introduced to the matching of an unknown spectra with a library. The characteristics and theory of FTIR are being studied in Instrumental Analysis. The quantitative and qualitative aspects are being used in Organic, Qualitative Organic, Polymer Chemistry and in the undergraduate research program. Physical characteristics of chemical bonding and kinetics are being studied in Physical Chemistry and Inorganic Synthesis. The students are gaining a deeper appreciation and broader perspective of modern high technology which should increase their enthusiasm for Chemistry. The technique which is widely used in industry and graduate research is allowing the students to have hands-on experience using a computer controlled data manipulation device that is one thousand times faster than a dispersive infrared instrument.

The grantee is matching the award from non-Federal sources.

RESEARCH IN TEACHING AND LEARNING

Hilda Borko	MDR 8652476
Catherine A. Brown	FY88 $131,996
Margaret A. Eisenhart	FY89 $132,665
Robert G. Underhill	FY90 $ 67,014
Virginia Polytechnic Institute and State University	Mathematics
Blacksburg, VA	

"Learning How to Teach Mathematics: The Evolution of Novice Teachers' Instructional Decisions and Actions"

This project will investigate the relatively unexplored area of how beliefs, knowledge, decisions and actions of people in the process of becoming middle school teachers of mathematics change during their training and first year of teaching as they begin to make the transition from novices to experienced teachers. In conceiving the study, these investigators bring together the concepts of (1) teacher beliefs and knowledge, (2) decisions and instructional strategies used by teachers, and (3) environmental influences including both contextual and social factors present in the schools where teachers study and work. These are used to form a framework for understanding the changes over time in the manner in which new teachers identify and respond to situations in which problems and opportunities arise during instruction. The study will employ a case study approach to describe the detail and complexity of the succession of decisions and actions of novice teachers during the final year of preservice preparation and first year of teaching middle school mathematics. Particular attention will be given to the ways these teachers plan, implement, and reflect upon the mathematics instructional units they teach.

STUDIES AND ANALYSES

Edgar L. Edwards, Jr.	OSPA 8651512
Va State Department of Education	FY86 $74,469
Richmond, VA	FY87 $82,004
	FY88 $41,050
	Studies

"A Model for Statewide Mathematics Assessment in Virginia Based on the Second International Mathematics Study"

This is a three-year project to develop a state-level model for the International Mathematics Assessment. The state of Virginia is designing and conducting a comprehensive survey of the eighth and twelfth-grade mathematics programs for the Commonwealth of Virginia and for two selected school divisions within the Commonwealth. The findings will be used to identify strengths and weaknesses of the mathematics curriculum at the state and division levels, in light of SIMS data available on the National and international levels.

The resulting information will be taken into account in curriculum reform activities in the Commonwealth. This application of the SIMS methodology is expected to provide a powerful model for assessing mathematics programs that will be used elsewhere within Virginia and could have utility in other state and regions of the United States, as well.

COLLEGE SCIENCE INSTRUMENTATION

Michael A. Pleva	USE 8750106
Washington and Lee University	FY87 $30,850
Lexington, VA	Chemistry

"Nuclear Magnetic Resonance Spectroscopy"

The recent acquisition of a nuclear magnetic resonance (NMR) spectrometer by the Chemistry Department at Washington and Lee University is affording students additional opportunities to become familiar with a broad spectrum of modern instrumental techniques. Specific applications of NMR spectroscopy have been incorporated into quantitative analysis, organic chemistry, organic qualitative analysis, instrumental analysis, and biochemistry. In addition, NMR is used extensively in the undergraduate research participation program, which has been a strong emphasis in the Department for many years.

VIRGIN ISLANDS

COLLEGE SCIENCE INSTRUMENTATION

Lynn Rosenthal	USE 8750928
College of the Virgin Islands	FY87 $17,510
Charlotte Amalie, VQ	Multidisciplinary

"Computer Graphics Laboratories for Dynamic Modeling and Visualization of Mathematical and Scientific Systems"

The College of the Virgin Islands will help its science and mathematics students better to visualize mathematical functions and relationships, and develop a quantitative intuition for the dynamic behavior of systems and the effects of changes to systems, cognitive skills which are difficult to impart in classroom situations. The use of more powerful hardware with good graphics capabilities and an icon user interface, coupled with availability of general tools for student exploration, provides an environment where these skills can be acquired. This project will provide student labs equipped with such facilities for use in all science and mathematics programs, and enable the College to enrich its science students' learning experiences and increase their exposure to new computing techniques. The college will purchase Macintosh graphics computers, networking hardware, and software.

WASHINGTON

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Jeffrey W. Morse
Science
Charles Wright Academy
Tacoma, WA

Thomas Seidenberg
Mathematics
Eisenhower Senior High School
Yakima, WA

1988

Lynn I. Sedgwick
Mathematics
Woodinville High School
Woodinville, WA

Patrick G. Ehrman
Science
A C Davis Senior High School
Yakima, WA

COLLEGE SCIENCE INSTRUMENTATION

William C. Smith USE 8750132
Central Washington University FY87 $50,000
Ellensburg, WA Geology

"Undergraduate Instruction in Geographic Information Systems"

The Geographic Information Systems Laboratory at Central Washington University provides computer hardware and software support for geographic information systems applications, allowing users to store, retrieve, display, manipulate and analyze maps and other spatial data. A state-of-the-art tool for data processing in the earth sciences and in resources management fields, the GIS Lab heretofore has been used primarily as a research facility; equipment needed for purposes of undergraduate instruction has been lacking. The University is buying a Masscomp computer system, 3 color and 6 monochrome terminals, software, and communications hardware. By providing necessary equipment, the project will enable the University to realize the GIS Lab's great potential as an undergraduate teaching facility, and thereby respond to growing student interest reflecting the rapid expansion of GIS application in academic research, government, and industry.

COLLEGE SCIENCE INSTRUMENTATION

Norman H. Wolford USE 8851476
Central Washington University FY88 $49,889
Ellensburg, WA Electrical Eng

"An Integrated Approach to Microprocessor and Microcomputer Education"

This project provides two state-of-the-art microcomputer systems to replace obsolete PDP-11 minicomputers and associated first generation microprocessor trainers. These systems are networked to a basic and an advanced microprocessor training laboratory. Each laboratory incorporates 12 workstations; consisting of a terminal, an Educational Computer Board and a solderless breadboard for experiments. The basic laboratory uses an 8-bit microprocessor and is used to instruct Electronic Engineering Technology majors and non-majors; including future technology education teachers. The advanced laboratory is used to provide instruction in microprocessor systems to the four-year graduates of the Electronic Engineering Technology and the Industrial Electronics Programs. This laboratory upgrade significantly improves the quality of education offered by the Department of Industrial and Engineering Technology by proving common equipment throughout the laboratory program and increased laboratory productivity through better hardware and software reliability.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Michael A. Brzoska USE 8750650
Eastern Washington University FY87 $8,052
Cheney, WA Mechanical Eng

"An Upgraded Undergraduate Materials and Mechanical Engineering Laboratory"

A Hewlett Packard 310 computer and data acquisition system is being added to the existing materials testing and fluids mechanics laboratory. Students in the Department of Technology will conduct experiments in fan performance measurement, flow blockage, and tensile measurements. In a unique experiment structure the students will study the principles of computer aided data acquisition first. Using existing software, the students then will conduct experiments in measuring the performance of fans, to include computer calculated performance curves. Finally, the students will be given an open-ended experiment to design, write the software and prepare computer generated reports. This structure, covering experiments from "canned" to open- ended, will provide the student with an excellent understanding of computer-aided experimentation.

COLLEGE SCIENCE INSTRUMENTATION

Hugh D. Sullivan	USE 8851382
R. William Clark	FY88 $66,348
Eastern Washington University	Electrical Eng
Cheney, WA	

"Advanced Workstation Applications and Graphics Laboratory"

The Advanced Workstation Applications and Graphics Laboratory includes a number of scientific workstations in a network with peripherals such as printers, plotters, a video recorder and associated software. The system is expandable and could include as many as 40 workstations. The laboratory network is connected to a campus network to extend access. The laboratory is expected to: 1) improve instruction in the sciences through detailed visual displays of molecular structures, simulations of complex systems, complex mathematical surfaces and functional relationships; 2) provide students with the tools for computer graphics and other applications requiring complex, high-speed computations such as CAD, map preparation from large data bases, and modeling of electronic and molecular structures; 3) provide students with state-of-the-art instruction in computer graphics; 4) prepare high-quality, sophisticated courseware which requires high-resolution graphics.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Neil E. Jacobsen	USE 8852442
Evergreen State College	FY88 $64,410
Olympia, WA	Chemistry

"High Field Fourier Transform Nuclear Magnetic Resonance (NMR) in an Integrated Physical Science Curriculum"

The Chemistry faculty are updating and expanding their Chemistry and Biochemistry curriculum. A high-field Fourier Transform NMR spectrometer is being used in the teaching of Organic Chemistry, Physical Chemistry, and Biochemistry as well as in student-initiated studies and faculty sponsored research. The capability of obtaining high-resolution proton and carbon-13 spectra of complex molecules is essential in structure determination of natural products, verification of synthetic products, and the study of reaction mechanisms. Hands-on student exposure to a technology as important to the chemical and biological sciences as high-field NMR is dramatically improving the teaching of science at Evergreen. The instrument is being use as the primary analytical tool in Organic Chemistry, and is exposing students in Physical Chemistry and Biological Sciences, through specific experiments and student projects to the technique.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

James M. Stroh	USE 8750411
Evergreen State College	FY87 $42,996
Olympia, WA	Multidisciplinary

"Upgrading the Undergraduate Interdisciplinary Science Programs with X-Ray Microanalysis and Scanning Electron Microscopy"

This project will upgrade and expand the undergraduate curricula in biological and earth sciences through the acquisition of an energy dispersive X-ray scanning electron microscope. The microscope will be used for class laboratory exercises in intermediate and advanced level environmental science (biology and earth sciences) and "laboratory" biological science programs, and also for independent undergraduate research projects in these fields. Through use of the instruments, students will be able to observe examples of phenomena and principles discussed in texts, will learn widely used modern instrumental techniques, and will be enabled to pursue independent research using these techniques.

COLLEGE SCIENCE INSTRUMENTATION

Frederick D. Tabbutt	USE 8750598
Evergreen State College	FY87 $39,887
Olympia, WA	Chemistry

"Improving the Undergraduate Chemistry Curriculum with a Gas Chromatograph-Mass Spectrometer"

A computer-based gas chromatograph with a mass selector detector (GC/MS) is being used by the Chemistry Department at Evergreen State College for undergraduate instruction in organic chemistry, physical chemistry, environmental chemistry and faculty/student research. By coupling this instrumental unit with an existing laboratory computer network system, the advantages of computer interfaced analytical instrumentation in the sciences are also being demonstrated.

FACULTY ENHANCEMENT

Frederick D. Tabbutt	USE 8854220
Robert S. Cole	FY88 $46,375
Evergreen State College	Chemistry
Olympia, WA	

"An Undergraduate Faculty Workshop on Computer-Based Laboratories for Introductory Chemistry and Physics"

Evergreen State College will offer a two-week workshop during the summer of 1988 focusing on computer-based laboratory curricula for introductory college physics and chemistry courses.

The audience for the workshop is physics and chemistry faculty from colleges around the country. The purpose of this workshop is to:

* demonstrate new ways of teaching introductory students to use personal computers as a laboratory tool to log, manipulate, analyze, interpret, and present experimental data.

* explore the novel and unique laboratory experiments developed as part of the science program at the Evergreen State College.

* demonstrate Evergreen's method of using laboratory explorations as a means of integrating the teaching of introductory calculus, chemistry and physics at the college level.

The twenty participants selected for this interdisciplinary workshop will engage in hands-on exploration of laboratory computer equipment, software, and experiments.

In addition to NSF funds, the college will provide about 15% in personnel time and participants will contribute about 15% in travel costs to the actual cost of the project.

COLLEGE SCIENCE INSTRUMENTATION

Ferd H. Mitchell	USE 8750725
Gonzaga University	FY87 $50,000
Spokane, WA	Electrical Eng

"A Multiple Local Area Network for Undergraduate Engineering Education in Computer-integrated Design and Manufacturing"

This project will integrate existing computer-aided design (CAD) and computer-integrated manufacturing (CIM) facilities with a multiple local area network resulting in an innovative undergraduate interdisciplinary laboratory. The laboratory will use the new Manufacturing Automation Protocol (MAP) to control a hybrid electronics manufacturing facility. Both electrical and mechanical engineering laboratories will provide the student experiences in the interrelationships among engineering theory, the laboratory, design and manufacturing.

COLLEGE SCIENCE INSTRUMENTATION

Peter G. Pauw	USE 8851591
Gonzaga University	FY88 $26,065
Spokane, WA	Biology

"Studies for an Advanced Undergraduate Genetics Curriculum"

The purpose of this project is to develop a modern Advanced Genetics curriculum. The course developments being funded include laboratory courses in Somatic Cell Genetics and Microbial Genetics. These courses teach concepts and techniques of modern genetic approaches to answering questions about biological structure and function.

Specifically, course development is employing new equipment for the culture, observation and storage of animal cells, including CO2- regulated incubators, biological containment hoods, inverted phase- contrast microscopes, and cryogenic freezers. In addition, gel electrophoresis apparatus and other equipment are being acquired for the biochemical analysis of alterations in gene expression that can be detected in cell culture and microbial models.

In addition to these specific course developments, the equipment permits a greater involvement of undergraduates in meaningful individual directed-research projects. The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Virginia B. Brown	USE 8750901
Heritage College	FY87 $16,309
Toppenish, WA	Biology

"Instrumentation for Undergraduate Biochemistry and Cellular Biology Laboratories"

The high-speed centrifuge, chromatography refrigerator, fraction collector and support equipment acquired in part through this grant are being used to strengthen upper-division laboratory courses in Biochemistry and Cellular Biology for students who are predominantly female, American Indian, and older than the traditional undergraduate. During the past year, this relatively new independent institution has received accreditation and instituted a four-year curriculum in Science and Mathematics. Funds were obtained from Federal and corporate sources to implement the basic curriculum. The goal of the current project is to develop and enhance capabilities for giving students needed laboratory experiences in upper-level courses in such areas as protein purification and characterization, and the investigation of cellular components. The new instruments are essential components of technical skill training in Biochemistry and Cellular Biology in that they support approximately one third of the experiments in these laboratory courses. This instrumentation also is being used to support experiments in other upper- and lower-division courses in the Science curriculum.

The program is designed to meet the needs of students who, despite limitations in their precollegiate science training, are seeking an education that will adequately prepare them for successful careers in technology, teaching or nursing.

COLLEGE SCIENCE INSTRUMENTATION

Edward J. Bauman — USE 8750819
Seattle Pacific University — FY87 $44,964
Seattle, WA — Electrical Eng

"Undergraduate Instrumentation and Design Computer Workstations"

The goal of this project is to provide electrical engineering undergraduate students with a unique, low cost and modern approach to laboratory instrumentation, circuit and system design. A prototype computer workstation has been created that allows the students to quickly access hardware and software programs so they can do both analysis and design of circuits and systems. The equipment to be purchased will extend the capabilities of the workstations and provide an adequate number to service the entire electrical engineering curriculum.

A/D and D/A converters and software added to the personal computers will allow real time digital control, data acquisition and signal processing. Digital scope interfaces will make the computer a storage scope and will allow signal analysis via computer programs. A logic interface turns the personal computer into a powerful, menu driven logic analyzer. With powerful software design tools and interface hardware the students can design, simulate, and test circuits and systems from the computer workstation.

COLLEGE SCIENCE INSTRUMENTATION

Lyle B. Peter — USE 8852019
Seattle Pacific University — FY88 $34,381
Seattle, WA — Chemistry

"Nuclear Magnetic Resonance Spectroscopy in Undergraduate Laboratories"

A Nuclear Magnetic Resonance Spectrometer equipped with a decoupler accessory is adding to the student's laboratory experience in several levels of undergraduate courses. New experiments are being added to the organic course to introduce the students to the instrument. This is being followed with new experiments in Inorganic, Physical, Analytical and Biochemistry laboratory courses. The instrument is also providing expanded opportunities for undergraduate research.

The grantee is matching the award from non-Federal funds.

COLLEGE SCIENCE INSTRUMENTATION

David C. Brubaker — USE 8852851
Seattle University — FY88 $84,617
Seattle, WA — Computer Science

"An Interdisciplinary Approach to Data Management in Undergraduate Instruction"

This project seeks to provide an interdisciplinary approach for undergraduate study of modern data management techniques and an interdisciplinary team approach to environmental problem solving. This program builds on the Biology Department experience with microcomputer-based laboratory work stations and the Civil Engineering Department Design Center concept. The work stations interface digital laboratory equipment, hand-held data loggers and weather telemetry instruments with data acquisition hardware providing rapid data acquisition, computer analysis and evaluation. The program focuses on collaborative work in sanitary and toxic waste management, which requires training in modern data management techniques and interdisciplinary approaches to problem solving. Students learn data management and instrumentation techniques through course work, laboratory exercises and an interdisciplinary design project. Students benefit through learning and practicing modern data management techniques appropriate to their disciplines and have the experience of working together as a team to find solutions to the environmental problems. This interdisciplinary approach models real life situations, increases student confidence in problem solving ability, and opens new career opportunities for students in both departments.

The grantee provides funds for this project that are an equal match for the NSF award.

COLLEGE SCIENCE INSTRUMENTATION

Gary J. Erickson — USE 8750312
Seattle University — FY87 $49,150
Seattle, WA — Electrical Eng

"An Undergraduate Very Large Scale Integrated Circuit Design and Test Laboratory"

A laboratory with four Sun Microsystems 3/110L microcomputers and peripherals will be integrated into the three course sequence in VLSI design. After a course in semiconductor materials, the students will be introduced to VLSI circuit design using modern workstations. As part of the laboratory, the students will design a circuit which will be fabricated at a foundry. Finally, the students will test their designs using automated test equipment.

COLLEGE SCIENCE INSTRUMENTATION

Rolf T. Skrinde	USE 8750571
Seattle University	FY87 $7,682
Seattle, WA	Civil Eng

"Enhancing Undergraduate Laboratory Experiences in Wastewater and Hazardous Waste Treatment"

In this laboratory project, students will use an Activated Sludge Pilot Plant to study the activated sludge process for treating non-hazardous and hazardous wastes and the anaerobic decomposition of the sludge produced. The laboratory will run concurrently with the lecture classes, thus clarifying the student's understanding of the processes involved. Using teaching microscopes, the students will observe waste water biota under various conditions of substrate metabolism. They will be able to observe which kind of sludge works well on given sewage feeds and settles well. Analysis with a gas chromatograph of the off-gas produced during anaerobic digestion of the sludge will allow the student to evaluate the kinetics and biological reactions involved in each treatment operation.

COLLEGE SCIENCE INSTRUMENTATION

Rolf T. Skrinde	USE 8852097
Seattle University	FY88 $13,410
Seattle, WA	Civil Eng

"Enhancing Laboratory Experiences in Wastewater and Hazardous Waste Treatment"

This project enhances the existing program in Wastewater and Hazardous Waste Treatment. With the ion chromatograph obtained with this award, students are able to study industrial and hazardous waste treatment in a hands-on laboratory at the same time they are studying the concepts in the classroom.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Nader Ghafoori	USE 8750674
St Martin's College	FY87 $29,632
Lacey, WA	Civil Eng

"Improvement in Engineering Education through Computer Aided Design and Drafting"

The civil engineering program is being modernized and strengthened with the introduction of computer-aided design and drafting. The system is being used in varying degrees in different courses ranging from basic technical drafting to courses in structural mechanics. The software will give the students the opportunity to use state-of-the-art techniques in the calculation and design of structural building systems. Finally, the laboratory will support the surveying courses eliminating many of the hand calculations now required.

TEACHER ENHANCEMENT PROGRAM

Norman R. Anderson	TPE 8650134
University of Puget Sound	FY86 $ 64,773
Tacoma, WA	FY87 $ 67,175
	FY88 $ 21,574
	Elem Science

"Elementary Education - Competence/Leadership"

The University of Puget Sound is providing an opportunity for elementary teachers to upgrade their science background and competence in Phase I of this three-phase project. Phase II is designed to develop concepts that they will be teaching, and Phase III will assist these teachers to develop skills of leadership and communication that will help them to be resource leaders in their own schools.

Intensive summer work is followed by academic year follow-up in which the teachers will engage their students in the activities of science. Assessment of this effort will be followed by any needed changes in the program as well as the movement toward working effectively with their peers as resource persons.

COLLEGE SCIENCE INSTRUMENTATION

Keith O. Berry	USE 8750284
University of Puget Sound	FY87 $50,000
Tacoma, WA	Multidisciplinary

"Multidisciplinary X-ray Laboratory"

The Chemistry, Geology, and Physics departments are establishing a new X-ray laboratory. Instruments in the laboratory (X-ray diffractometer for powders and X-ray spectrometer) will be used to support several courses offered in the undergraduate curriculum. In addition, the instruments are being utilized by both faculty and students for support of the undergraduate research program at this institution. The departments are committed to educating students through hands-on experiments, utilizing a variety of instruments. Rather than through a single course in which the instruments are being used, an effort is being made to integrate applications of X-ray methods throughout the entire curriculum. A Phillips PN1430 spectrometer coupled with the Phillips PW1840 diffractometer offered the greatest cost advantage to the university. The system includes a matched computer system interfaced to the instruments.

COLLEGE SCIENCE INSTRUMENTATION

J. Stewart Lowther USE 8750167
University of Puget Sound FY87 $34,682
Tacoma, WA Geology

"An X-ray Microanalysis System for Undergraduate Geology"

The Department of Geology at the University of Puget Sound will purchase an energy-dispersive quantitative X-ray microanalysis system with image processing capabilities to be mounted on an existing scanning electron microscope.

This instrumentation will be integrated into the undergraduate geology curriculum at all levels above the introductory courses and will be used for student and student-faculty research projects. The equipment will allow students to analyze the chemical composition of very small regions of rock and mineral samples and thus assist in the identification and characterization of the samples. A modern laboratory facility now houses the University's electron microscope and will house the new system.

COLLEGE SCIENCE INSTRUMENTATION

Terrence R. Mace USE 8750166
University of Puget Sound FY87 $18,471
Tacoma, WA Biology

"Equipment to Quantify Undergraduate Course Work and Independent Studies in Animal Behavior"

This project is expanding and strengthening undergraduate offerings in animal behavior and behavioral ecology through the purchase of equipment that makes it possible to quantify aspects of what has been largely a descriptive field. It facilitates expansion of the range of techniques introduced and used in the laboratory exercises of the Animal Behavior course, and increases the diversity and sophistication of independent study and/or senior thesis projects available to students interested in these areas.

The students use the event recorders to document sequences and temporal patterning of behavior. Tape recorders, a sonograph and a sonogram digitizer are allowing students to record and analyze vocalization in detail -- critical elements in understanding territoriality, breeding behavior and other aspects of animal interaction. A motion analyzer makes possible detailed examination of locomotion, stimulus-response sequences, and related phenomena.

COLLEGE SCIENCE INSTRUMENTATION

Kenneth Rousslang USE 8750047
University of Puget Sound FY87 $25,500
Tacoma, WA Chemistry

"Integration of a Fourier Transform Infrared Spectrometer into the Chemistry Undergraduate Curriculum"

A Fourier Transform Infrared Spectrometer is being used by the Chemistry Department at the University of Puget Sound to demonstrate state-of-the-art analytical techniques in six upper division courses: Physical Chemistry Laboratory, Spectroscopic Identification of Compounds, Inorganic Chemistry, Instrumental Analysis, Group Theory and Molecular Spectroscopy, and Forensic Chemistry. The inherent sensitivity, reliability, expanded wavelength capability and flexibility of this instrument affords students an expanded range of undergraduate educational experiences.

COLLEGE SCIENCE INSTRUMENTATION

Carol M. Smith USE 8750013
University of Puget Sound FY87 $31,405
Tacoma, WA Computer Science

"Development of an Undergraduate Computer Graphics Laboratory"

A computer graphics laboratory using Tektronix computer graphics terminals is being developed. The laboratory will support a new computer graphics course and an on-going program of student research. The new course will emphasize the applications of mathematics to computer graphics and will enable students to study and experiment with the algorithms and mathematical techniques of two and three dimensional graphics.

COLLEGE SCIENCE INSTRUMENTATION

Alan S. Thorndike USE 8750048
University of Puget Sound FY87 $6,440
Tacoma, WA Physics

"An Undergraduate Fluid Phenomena Laboratory"

The physics department at the University of Puget Sound will purchase temperature-control circulators, chart recorders, and a freezer to enable students to perform advanced laboratory experiments and projects in several areas of fluid mechanics. They will carry out experiments in such areas as the physical properties of fluids, the transition to chaos in convecting systems, and the unstable convection which is set up as sea water freezes. In addition to experiments for the upper-division laboratory, the fluids lab will involve two or three students each year in independent study projects which are required for the B.S. in Physics.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Thomas G. Stoebe	MDR 8751287
Patricia M. MacGowan	FY88 $176,041
University of Washington	FY89 $227,930
Seattle, WA	FY90 $285,957
	Mathematics

"Washington Middle School Engineering Program"

This proposal involves the expansion of MESA (Mathematics, Engineering, Science Achievement) model to the junior high/middle school population in the State of Washington. The project will focus on updating and revitalizing middle school mathematics curriculum, the goal being to increase minority student enrollment in algebra in the ninth grade. The MESA model also recognizes the need for teacher support and provides teacher seminars on a regular basis. Additionally, the expansion of the statewide Pre- College Center at the University of Washington will include the coordination of a statewide program at the junior high/middle school level.

The MESA model is based on a partnership between industry and educators -- a cooperative effort involving scientists on loan from industry and educators at the university and secondary school levels -- working together to develop curricula that will stimulate student interest and achievement in mathematics and science.

TEACHER ENHANCEMENT PROGRAM

Darrell J. Woodman	TPE 8652404
University of Washington	FY87 $185,730
Seattle, WA	Chemistry

"University of Washington Precollege Chemistry Teacher Program"

Under this project, the department of chemistry of the University of Washington will conduct a four-week in-service institute for 30 precollege chemistry teachers from Washington and other states in the Pacific Northwest, during each of the summers of 1987, 88, and 89. Follow-up activities, aimed at establishing a lasting network for regional teachers, will include the development of curricular units and various modes of inservice teaching by institute graduates, the creation of academic year minicourses, and the continuing exchange of new institute materials.

The content of the workshop, based on experience in the summer of 1986, will feature lectures on "The Interactions of Energy with Matter" and a second series of lectures which will address different themes in each of the project years: "The Chemistry of Metals," "Chemistry of Non- Metals," and "Environmental Chemistry." In addition, each summer will feature a component on the Frontiers of Chemistry, including lectures and site visits on such subjects as Environmental Chemistry, Modern Analytical Chemistry, Surface Chemistry, and Medical Imaging. Three afternoons per week will be devoted to laboratory work, participants will receive assistance in preparing and presenting demonstrations, and there will be an introduction to the use of computers in chemistry. In addition, all participants are expected to give pedagogical presentations to their colleagues, to prepare a library report, and to participate in workshop sessions devoted to issues in teaching.

Thirty teachers (estimated to be 27 from high school and 3 from junior high school) will be selected each year from applications solicited from Washington and other states in the Pacific Northwest. Non-commuters will be housed and fed at the University and all will receive stipends of $200 per month. The teachers will receive nine academic quarter credits for their participation in this institute, and another two on completion of a curriculum unit. Outreach and network activities are expected, and will be supported by academic year minicourses.

TEACHER ENHANCEMENT PROGRAM

Glenn A. Crosby	TPE 8751116
Washington State University	FY87 $144,924
Pullman, WA	FY88 $ 15,365
	Chemistry

"Northwest Regional Leadership Workshop for High School Teachers of Chemistry"

Twenty-four chemistry teachers who participated in this workshop in the summer of 1987 and 10 additional chemistry teachers will participate in a 10-day workshop in the summer of 1988. The purpose of this workshop is to design detailed plans for outreach teams for the Northwest.

A manual which includes demonstrations, safety instructions, and "Do's and Don't's" will be prepared for use and disseminated by the outreach teams in their workshops. Video tapes, experiments and other activities designed to improve secondary chemistry teaching will be prepared. Each outreach team will conduct several sessions during the 1988-89 academic year. The project staff will coordinate these activities.

YOUNG SCHOLARS

Joseph G. Cvancara	RCD 8755774
Larry Hiller	FY88 $36,240
Everett L. Martin	FY89 $36,240
Ralph P. Cavalieri	Life Sciences
Jill E. Armstrong	
Washington State University	
Pullman, WA	

"WSU/UI Young Scientists Program"

Washington State University and the University of Idaho seek to stimulate interest in science careers among highly qualified 9th and 10th graders in linkages between high school science teachers and university faculty located at several regional experiment stations throughout the two states. A two-week on-campus summer workshop features four sessions (5 hours) in animal science, plant science, engineering and food science/nutrition during the first week. In the second week pairs of students spend four days in an intensive mentoring relationship in a laboratory. Special sessions on career exploration, research methods and ethics in science assure that students are sensitive to these issues.

A follow-up activity of 6-8 months duration involves students, their high school science teachers and university scientists in an independent project. The project concludes with regional one-day seminars involving 6-8 students, their teachers and mentor-scientist in a reporting and evaluation session.

TEACHER ENHANCEMENT PROGRAM

Duane W. De Temple
Jack M. Robertson
Washington State University
Pullman, WA

TPE 8751731
FY88 $75,518
Mathematics

"Conceptual Aids for Learning the Calculus (CALC)"

The main goals of the project are to provide inservice opportunities to thirty high school mathematics teachers in the Pacific Northwest who have taught or will be teaching calculus in either a standard twelfth- grade course or an Advanced Placement course. The vehicle for the inservice experiences is a collection of "mathematical jewels" dealing with captivating approaches to calculus concepts that differ from those in ordinary textbooks. The jewels are to be collected in a Handbook of Conceptual Aids for Learning the Calculus. It should be emphasized that the approach taken in the Handbook is to offer enriching activities the teachers can use to provide motivation to their students so as to avoid a traditional way of teaching calculus which often "...is commonly reduced to a technical journey through a textbook, lacking that extra insight, example, illustration or application which brings the subject alive..."[Page 10, of the proposal narrative]. The schedule calls for development of the teacher handbook, during the summer 1988, to be written primarily by the project staff and based upon previous work with teachers. In August, 1988 there is scheduled a conference for five teachers and the two principal investigators. The teachers have already been selected and will be instrumental in the field test efforts of the project. During October 1988 the staff and field test teachers will, at the Northwest Mathematics Conference, present ideas from the project work up to that point and recruit participants for the summer conference. During the following winter term the staff will visit the schools of the five pilot teachers and work extensively with students at that time. Later that spring there will be a two-day conference of the pilot teachers and the principal investigators to develop a detailed outline of the materials to be revised. During the following summer, 1989, there will be an intensive conference for 25 participants in addition to the pilot teachers. The goal is to provide the teachers with a deeper understanding of the calculus by using classroom examples, illustrations, and applications that are compiled in the handbook. It is not the intention that the workshop is to be a course in calculus, as such, but rather an enriching and in-depth experience for the teachers with the goal that they, in turn, will be able to provide similar experiences for their students within the context of a full-year calculus course. Also, during that summer, the handbook will be revised according to the reactions and input from the participants.

RESEARCH IN TEACHING AND LEARNING

Douglas B. McLeod
Washington State University
Pullman, WA

MDR 8696142
FY86 $180,800
FY87 $ 82,357
Mathematics

"Mathematical Problem Solving: Affective Influences on Cognitive Processes"

Research on mathematical problem solving has made substantial progress in characterizing the cognitive processes that are important to successful performance. However, the influence of affective factors on these cognitive processes has yet to be studied in detail. The purpose of this project is to investigate the affective factors that help or hinder performance in mathematical problem solving.

The major activities of the project include the development of a theoretical framework for affective factors in problem solving, the gathering of empirical data in both laboratory and classroom settings to provide a preliminary test of the theory, and dissemination of the results to both researchers and practitioners.

The theoretical development will be guided by an interdisciplinary team including cognitive scientists and mathematicians, as well as mathematics education researchers and practitioners. This group will meet first to discuss related theory (especially that of Mandler) and to outline a series of empirical studies. A year later they will meet again to discuss the results of the studies, to tailor the theoretical ideas to meet the needs of mathematical problem solving, and to disseminate the results to both researchers and practitioners.

COURSE AND CURRICULUM

Michael E. Moody
Michael J. Kallaher
Washington State Univ
Pullman, WA

USE 8814131
FY88 $29,716
Mathematics

"Development of Computer-Based Curriculum Materials for Calculus: A Planning Project "

Mathematicians at Washington State University will develop, coordinate, and write multi-disciplined computer-based curriculum materials for Calculus to be implemented at two high schools, a community college, a private college and a public university. Generic curriculum materials for Engineering Calculus, Calculus for Life Sciences, and Business Calculus will be developed by faculty from engineering, biology, chemistry, business and sociology.

The materials will include "laboratory" exercises that use computing devices such as HP-28 and microcomputers using symbolic manipulation programs. These realistic problems will use numerical methods that illustrate the power, difficulties and logic of computation and graphical solution to problems.

Electronic "slide shows" with both animated and static computer graphics of classroom demonstrations and lectures will also be developed.

The principal investigators are well known researchers, who have wide range experience in mathematics education. They will work closely with Pullman and Moscow High Schools, Spokane Falls Community College and Gonzaga University.

COLLEGE SCIENCE INSTRUMENTATION

Richard Feinberg
Western Washington Univ
Bellingham, WA

USE 8851148
FY88 $10,422
Physics

"Instrumentation for an Undergraduate Laser Spectroscopy Laboratory"

The grantee will acquire instrumentation which will provide students in Optics Concentration with hands-on exposure to modern methods of laser spectroscopy, optical detection, signal processing, and computer-based data acquisition.

The Physics Department will purchase a PRA LN120C2 Combination Nitrogen/Dye Laser System, a Stanford Research Systems Model SR400 Gated Photon Counter, and an IBM PC/XT Compatible Computer.

These instruments form a versatile combination which will enable the students to perform a wide variety of laser spectroscopy experiments in absorption, fluorescence, Raman, opto-acoustic, opto-galvanic, and photothermal deflection spectroscopy. In addition, the nitrogen/dye laser system will serve as a teaching tool for the study of these important laser types.

This project is significant because it brings to the undergraduate laboratory devices and techniques which are routinely used in graduate, government, and industrial research laboratories. It will enable students to understand and utilize laser spectroscopic techniques for the analysis of matter at an earlier stage of their careers. Finally, it will serve other institutions through the publication of student lab experiments which will be developed.

The grantee will match the NSF award with an equal amount of funds.

FACULTY ENHANCEMENT PROGRAM

James Hearne
Western Washington Univ
Bellingham, WA

USE 8854179
FY88 $26,973
Chemistry

"Community College Workshop in Modes of Programming"

The Community College Summer Workshop in Modes of Programming will provide community college instructors in Washington State who teach computer science and related disciplines with active experience with new models of computer problem solving that are supported by high-level languages or established software packages of high-level building blocks. The specific topics are Expert Systems Programming, Fourth Generation Language Programming, Graphics Programming and Object Oriented Programming. Both the selection of topics and approach are designed to support curricular evolution in the community colleges by providing exposure to material which, though advanced, can be integrated into the community college computing curriculum.

In addition to NSF support, participants will contribute approximately an additional 15% toward the costs of the program.

COLLEGE SCIENCE INSTRUMENTATION

Hubertus E. Kohn
Western Washington University
Bellingham, WA

USE 8750902
FY87 $21,457
Biology

"Improvement of an Undergraduate Laboratory Curriculum in Molecular/Cellular Biology"

Many of the most important recent revolutions in science belong to Biology. The discovery of means to routinely isolate, sequence, and reintroduce genes into living cells has permanently changed biological teaching and research agendas. The tools of Cell Tissue Culture and Recombinant DNA Technology are providing the basis for an appropriate undergraduate education in modern Biology, and a hope for exploiting the future promise of Biotechnology.

This Department has identified Molecular/Cellular Biology as an area for increased emphasis and, using local resources, has partially equipped an area to include a functional Cell Tissue Culture Laboratory. The laboratory complex is housing a specially designed course "Cell/Tissue Culture", as well as supplementing student experimentation in the Botany, Microbiology, and Genetics courses. Also, a new B.S. degree program with an emphasis in Molecular/Cellular Biology is being inaugurated. Thus the equipment provided through this project is greatly expanding the efficiency, depth, and variety of possible student experimentation in the areas of Cell Tissue Culture and DNA Technology.

COLLEGE SCIENCE INSTRUMENTATION

Larry Menninga	USE 8852080
Western Washington Univ	FY88 $16,165
Bellingham, WA	Computer Science

"Computer Support for Real-time Programming Instruction"

This project supports enhancement of the Computer Science course in real-time and system level software development. Undergraduate students are exposed to a laboratory having dedicated machines (so that system level errors during software development do not disrupt other users) and high-level software development support and modern interfacing equipment so that practical projects can be carried out in the lab. The equipment supporting this lab includes; VME-bus based microcomputers with serial and parallel ports, floppy disk controller and drive and interrupt capabilities; debug monitor; and, cross-assembler.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Donald F. Calbreath	USE 8851287
Whitworth College	FY88 $9,400
Spokane, WA	Biology

"Equipment to Improve Undergraduate Course Work and Independent Study in Biochemistry"

This project involves acquisition of a refrigerated centrifuge for use in the undergraduate Biochemistry program. The centrifuge permits the preparation of materials for a wide variety of experiments that illustrate basic biochemical techniques used in laboratories associated with regular coursework. This acquisition also opens to undergraduates an array of additional independent research projects in Biochemistry, providing valuable preparation for the large percentage of students from this department who pursue professional education beyond the Baccalaureate.

These increased opportunities, while not novel, fill a gap in the previous Biochemistry Laboratory program, strengthening it in significant ways.

The grantee institution is matching the NSF award with a slightly greater sum obtained from non-Federal sources.

WEST VIRGINIA

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

Mark T. Allen
Science
Mount Hope Middle School
Mount Hope, WV

Deloris J. Lipps
Mathematics
Wirt County High School
Elizabeth, WV

1988

Darlene I. Boyles
Mathematics
Fairmont Senior High School
Fairmont, WV

Shirley S. Kelly
Science
DuPont High School
Belle, WV

COLLEGE SCIENCE INSTRUMENTATION

Kent C. Clinger	USE 8852446
Bethany College	FY88 $5,257
Bethany, WV	Biology

"Introducing Scintillation Counting into the Undergraduate Biochemistry Curriculum"

The liquid scintillation counter purchased through this project is making it possible to introduce the theory and techniques of scintillation counting into the undergraduate Biochemistry curriculum. The new machine is used to teach undergraduates how to count radioactive isotopes commonly found in industrial, medical, and academic laboratories. The instrument will be used also to study the transport of amino acids across biological membranes, to determine amounts of protein synthesis, and to find the rate at which two strands of DNA combining to form double stranded DNA interact. This instrument also will be used in a variety of undergraduate biological and chemical research projects.

This project will better prepare Biochemistry, Chemistry, and Biology students for success as scientists and medical professionals, and for their service to society.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

YOUNG SCHOLARS

Kent C. Clinger	RCD 8850176
Robert A. Paysen	FY88 $46,763
Bethany College	FY89 $46,763
Bethany, WV	Chemistry

"Northern Appalachian Water Quality Study for High Ability High School Students"

The departments of Biology and Chemistry at Bethany College conduct a six-week summer program to expose 20-25 high school students (grades 10 and 11) to an interdisciplinary study of a watershed environment that is influenced by agricultural, mining, and societal factors. The project goal is to encourage students from schools with limited facilities or who lack contacts with scientists to consider a career in science or engineering. Each participant becomes part of a research team composed of a senior researcher, a high school teacher and college student. After classroom instruction in scientific research methods, the students gather samples in the field and analyze them in the laboratory. Class topics include the effects of sewage treatment and mine and agricultural runoff on water quality. Experts in many science disciplines present seminars on factors that influence water quality.

FACULTY ENHANCEMENT

Kent C. Clinger	USE 8854219
John Burns	FY88 $27,130
Bethany College	Biology
Bethany, WV	

"A DNA Laboratory Workshop for Undergraduate Science Faculty"

Many exciting possibilities are now becoming realities in Biology and Medicine due to the use of recombinant DNA. Human insulin, growth hormone and several other hormones are now becoming available for the first time in quantity. Undergraduate students need to understand the fundamentals of these methods in order to participate in the future advances in Biology and Medicine.

A DNA Laboratory Workshop for Undergraduate Science Faculty is an intensive week-long program for small college teachers. The workshop, consisting of lecture, laboratory and discussion periods, will enable 25 science faculty who have never had "hands-on" experience with recombinant DNA laboratory techniques to gain familiarity with several of these techniques. These new techniques will then be taught in the undergraduate college setting.

The DNA workshop will be hosted by a consortium of eight Liberal Arts colleges in Ohio, Pennsylvania, and West Virginia (the East Central Colleges, or ECC), but will include science faculty members from about twelve to fourteen colleges. The instructional staff will consist of staff scientists from Cold Spring Harbor Laboratory, a leading laboratory in DNA research and education. The workshop will be held at Bethany College in Bethany, WV.

In addition to NSF funds, the participants' institutions will provide about 20% in travel funds.

COLLEGE SCIENCE INSTRUMENTATION

Alan R. White	USE 8750488
Marshall University	FY87 $42,460
Huntington, WV	Biology

"Instrumentation for a Core Undergraduate Course Laboratory in Cellular Biology"

The Department of Biological Sciences recently has implemented a curriculum revision involving the creation of three core courses for all majors - namely, Genetics, Ecology and Cell Biology. Of these, Cell Biology had not existed on this campus in the past and Genetics had been in need of revision. Instruments procured through this project are being used to provide current technology to the laboratory portions of both of these core courses.

Included among the new instruments are teaching and instructor's microscopes equipped with phase-contrast optics that provide for more effective observation of living cells, and an ultracentrifuge. The instruments are enhancing both laboratory teaching and student research projects by making the modern techniques of Light Microscopy and of Molecular Genetics (especially methods of isolating cellular components) available to undergraduates.

TEACHER ENHANCEMENT PROGRAM

George A. Seielstad	TPE 8751378
National Radio Astronomy Observatory	FY87 $106,262
Green Bank, WV	FY88 $298,641
	FY89 $273,095
	Astronomy

"Secondary Science Teachers' Institute"

Scientist and technical professionals of the National Radio Astronomy Observatory in Green Bank, West Virginia and science educators from West Virginia University in Morgantown are jointly proposing a Secondary Science Teachers' Institute for 150 selected high school teachers. The summer institute (a two-week session the first year and two three-week sessions in subsequent years) will include lectures in basic astronomy and demonstrations to give teachers resources they can use in their classrooms, including the use of an instrumented 40-foot telescope with which participants can make observations of their own. Over the three years of the project the system will be automated to the extent that electronic communication between the classroom and the telescope will permit observations to be made from the classroom. The overall goal of the project is to bring classroom teachers into direct contact with research scientists in order to foster a greater appreciation as to how science is conducted and how new knowledge is acquired.

Ronald G. Pearson	8751526
Joseph M. Hutchison	FY87 $111,700
James C. Shuman	Other NEC
Don J. Smith	
National Youth Science Camp Foundation	
Charleston, WV	

"National Youth Science Camp"

The National Youth Science Camp Foundation offers a three-week summer enrichment program for two outstanding high school graduates from each state who have interest in science careers. The goal of the program is to honor outstanding academic achievement, foster leadership development and encourage pursuit of science careers. Activities include lectures and seminars by noted scientists and community leaders, site visits to government and industry science facilities and a variety of recreational programs. This year lectures will be videotaped for distribution to schools across the state.

This program offers a unique opportunity for talented students and is similar in purpose to the Graduate Fellowship Programs.

COURSE AND CURRICULUM

Robert L. McConnell	USE 8854664
Wils L. Cooley	FY88 $170,436
Nigel T. Middleton	Electrical Eng
West Virginia University	
Morgantown, WV	

"Electrical Engineering Design Compendium"

The result of this project is a compendium of design problems and tutorials on certain aspects of design for use throughout the electrical engineering curriculum. The compendium is to be purchased by every entering Electrical Engineering student and problems from it are assigned during each undergraduate Electrical Engineering course. The following are some of the characteristics of the compendium:

1. The design problems deal with fundamental component-level design questions such as manufacturability-tolerance trade-offs, an area frequently neglected in design courses that concentrate on system level design.

2. The materials are in the form of small problems that a faculty member can use in class without making a major commitment to design or major changes in a course.

3. Sufficient resource material is included within the compendium to make it self-sufficient.

The grantee has committed support that is almost one-half of NSF funds for this project.

This project is co-funded with the NSF Directorate for Engineering.

COLLEGE SCIENCE INSTRUMENTATION

Betty F. Thacker	USE 8852741
Wheeling College	FY88 $23,600
Wheeling, WV	Biology

"Improving Data Acquisition and Analysis in the Undergraduate Biology Curriculum"

This Department is purchasing equipment to enhance the development of data acquisition and analysis skills in undergraduate students -- both majors and non-majors. Computer simulations and interactive videos are creating an environment in which non-major students can collect and evaluate data without being dependent on manual skills. This enables even scientifically naive students to become involved quickly in scientific pursuits and to begin to experience ways in which scientists solve problems. In upper level courses (including research projects) majors have opportunities to work with computer-interfaced instruments to speed data collection and to accomplish calculations that enable the student to interpret and draw conclusions from related groups of facts. The thrust of the project is to spend more time thinking about the implications of data sets than is spent in acquiring the factual information.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

WISCONSIN

Presidential Awards for Excellence
in
Science and Mathematics Teaching

1987

William R. Broniec
Science
J I Case High School
Racine, WI

John C. Burrill
Mathematics
Whitnall High School
Greenfield, WI

1988

Miriam L. Clifford
Mathematics
Bay View High School
Milwaukee, WI

Allan M. Stawicki
Science
Samuel Morse Middle School
Milwaukee, WI

COLLEGE SCIENCE INSTRUMENTATION

Alfred B. Ordman	USE 8851464
Beloit College	FY88 $78,097
Beloit, WI	Biology

"Equipment for an Undergraduate Biotechnology Laboratory Program"

Integrated biotechnology and computer laboratories for the Biochemistry program will be set up to train Biology, Biochemistry, Chemistry and other majors in recombinant DNA and monoclonal antibody production and scale-up methods. Because these methods have become basic to many areas of science, students should develop these skills as undergraduates for use in required internships and their own research.

The number of Biochemistry majors in this department has steadily increased over the past seven years; 80% of them going on to medical or graduate schools.

DNA electrophoresis and blotting equipment, an inverted microscope, an ultracold freezer, a preparative centrifuge, a fermenter and two spectrophotometers permit DNA restriction mapping, cloning, and the production of proteins and monoclonal antibodies. A Biology Computing Center is being established where faculty developed software allows students to gain experience with experimental design, data collection and analysis, in addition to their lab experience. Two innovative features of this project are 1) the integration of the hands-on labs with computer simulations, allowing for practical lab experience with realistic experimental design and data analysis in a short period at low cost, and 2) the way in which labs prepare students for internships and research where people cooperate on long- term projects that integrate several methods.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Richard C. Stenstrom USE 8852835
Beloit College FY88 $20,650
Beloit, WI Geology

"Rock and Mineral Sample Preparation for Chemical and Microscopic Analysis"

The grantee will purchase sample preparation equipment for use in undergraduate Geology laboratory courses. This equipment will be used by Geology students for courses in Crystallography, Mineralogy, Petrography, Petrology, and Sedimentology to prepare samples for a variety of analyses requiring a high degree of sample purity. Advanced undergraduates also will use the equipment for similar purposes in senior thesis work and independent projects.

The grantee will match the NSF equipment award with an equal amount of funds.

COLLEGE SCIENCE INSTRUMENTATION

James Lorman USE 8750548
Edgewood College FY87 $5,577
Madison, WI Biology

"Environmentally Controlled Chambers to Improve Project-Centered Experience in Biology for Non-Majors"

Student-originated projects involving scientific experimentation are a key component of the introductory natural science and biology courses required as a part of Edgewood's general degree curriculum. Environmental biology is an area popular with non-science majors. The goal of this project is to expand the experience in scientific problem solving that the College can provide such students. Approximately 75% of the undergraduates who will benefit from this project are female, and a large proportion (approximately 30%) are teacher education majors.

Using controlled environment chambers acquired through this project, students will be able to mount experiments in plant growth, plant- herbivore interactions and other aspects of environmental biology which require the ability to control such parameters as light intensity, light/dark periodicity, humidity, atmospheres and temperatures. The Department's ability to support controlled experiments in these areas should produce not only expanded experimental capabilities, but also increased interest and enthusiasm on the part of students and, most importantly, a better understanding on their part of the process of scientific inquiry.

COLLEGE SCIENCE INSTRUMENTATION

Philip K. Welty USE 8750475
Anne B. Swanson FY87 $8,985
Edgewood College Chemistry
Madison, WI

"Atomic Absorption Spectroscopy to Enhance the Undergraduate Laboratory Science Curriculum"

The recent acquisition, at Edgewood College, of an atomic absorption spectrometer allows students to perform experiments and undertake projects involving trace metals in biological and environmental samples. In an integrated, interdisciplinary course for non-science and teacher education majors, students carry out projects involving the analysis of trace amounts of heavy metal pollutants (lead uptake in plants and mercury in human hair). In chemistry courses, students determine metal ions in biological fluids, and pursue student-originated projects to investigate mercury contamination of water supplies and fish in Wisconsin waterways. Non-science majors studying geoscience gain an appreciation for atomic absorption spectroscopy as a powerful tool in geochemistry and chemical oceanography by investigating trace inorganic nutrients in natural waters and determining the trace metal chemistry of rock and ore samples.

This project helps to meet a need for instrumentation-based laboratory experiences which excite the imagination of non-science majors and improve the science education of our future teachers. About 75% of the students directly impacted are women. Publication of experiments developed will extend the impact of the project.

COLLEGE SCIENCE INSTRUMENTATION

Ann M. Penzkover	USE 8851410
Lac Courte Oreilles	FY88 $5,125
Ojibwa Community College	Chemistry
Hayward, WI	

"Project CABLE (Chemistry and Biology Laboratory Education)"

This college is located on the Lac Courtes Oreilles Reservation of rural Northern Wisconsin. The College population is 95% Native American, of which 70% are women. Due to the isolation of the Northern Wisconsin woodlands and the limited resources of the students, the College has become the focal point of educational services within the area.

Previously, science courses were taught with a minimum of laboratory work. Instructors prepared demonstrations for students to view in the local high school laboratory which is not equipped for scientific investigation beyond the secondary curriculum. The new laboratory equipment is providing the means to begin to explore Biology and Chemistry beyond the post-secondary level. Furthermore, Native American students are being given the opportunity to research scientific concepts at the experimental level which is consistent with Native American learning styles.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

John R. Brandenberger	USE 8750076
Lawrence University	FY87 $32,260
Appleton, WI	Physics

"Lasers and Modern Optics in Undergraduate Institutions"

Despite the growing importance of lasers and modern optics, undergraduate institutions rarely provide coursework in these increasingly pivotal areas. At a time when growing numbers of scientists are using lasers in research and when modern optics and microelectronics are spawning new technologies whose impact may rival that of the silicon microchip, undergraduates in this country remain largely on the sidelines.

Lawrence University is undertaking a pilot program designed to determine the staffing and hardware requirements for meaningful instruction in lasers and modern optics in undergraduate institutions. With support from the National Science Foundation and other sources, it will develop courses at several levels, devise suitable laboratory experiments, test various types of lasers and optical hardware, and develop instructional materials. Publications, visits, workshops, and outreach programs will serve to inform other institutions of the details of the findings. The primary objective is to demonstrate to others that undergraduate offerings in laser science and modern optics are feasible and overdue. Aspects of this program are expected to be emulated elsewhere.

The present grant will assist in the acquisition of electronic equipment for use in designing and operating the laser laboratories.

COLLEGE SCIENCE INSTRUMENTATION

David M. Cook	USE 8851685
Lawrence University	FY88 $49,433
Appleton, WI	Physics

"Scientific Workstations in Undergraduate Physics"

Sophisticated scientific workstations running powerful software are essential tools for practicing scientists and engineers, but undergraduate curricula nationwide are not responding vigorously to the challenge and opportunity provided by these devices. In response, the Department of Physics will construct a computation laboratory to support a major restructuring of its undergraduate Physics curriculum. The first phase of this project will build familiarity with computer-based tools by introducing suitable examples and exercises into the intermediate-level core of courses. As the students advance, more sophisticated exercises will be incorporated into advanced offerings. Through curricular revision, a departmental environment will be created within which undergraduates will become expert at using state-of-the-art computing tools intelligently, effectively, extensively, and independently. At the same time, the Department will be conducting a pilot project whose results will influence the course of Physics instruction at other schools during the coming decades.

The grantee institution is matching the NSF award with an equal sum obtained from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Peter S. Glick	USE 8750965
Terry L. Rew-Gottfried	FY87 $9,650
Lawrence University	Psychology
Appleton, WI	

"Improvement of Psychology Laboratory Curriculum"

A microcomputer network will be purchased to improve the content of laboratory portions of research design and cognitive psychology courses. Specific equipment includes six microcomputers connected in a network, data acquisition hardware (for speech digitization and analysis), and software for demonstration, simulation, and student conducted experimentation in cognitive, social, and perceptual psychology. These instruments will significantly improve these courses by presenting fundamental experimental paradigms and by facilitating active student participation in the design and conduct of research projects. This "hands-on" experience in the laboratory will introduce students to the essential methodologies of psychology and develop their critical skills. In addition, the equipment will be used for demonstration purposes in the areas of perceptual, social, and language psychology.

COLLEGE SCIENCE INSTRUMENTATION

Jerrold P. Lokensgard USE 8851800
Lawrence University FY88 $95,250
Appleton, WI Chemistry

"Acquisition of a High-field Fourier Transform NMR Spectrometer to Enhance Undergraduate Education in Chemical Spectroscopy"

A 250 MHz Fourier Transform Nuclear Magnetic Resonance (NMR) spectrometer is replacing a 14-year-old 60 MHz NMR spectrometer. The new instrument's ease of routine use, much higher sensitivity, and greater spectral dispersion is enhancing use of NMR in Organic, Inorganic, and Advanced Chemistry courses. In addition the laboratory experiences of intermediate and advanced Chemistry students, both Chemistry majors and others, is being enriched by important new NMR capabilities. Carbon NMR is taking its place alongside proton NMR as a key ingredient of the Organic Chemistry Laboratory. Students in instrumental analysis and advanced laboratory courses are exploring molecular structure using two-dimensional NMR analysis, obtaining meaningful kinetic data more easily, and better understanding fundamental principles upon which NMR experiments rest. The new instrument is enhancing research training of senior undergraduates by greatly extending the range of accessible projects for student independent study. The department's curriculum is being enlivened by the addition of these new capabilities, and its students are being better prepared for postgraduate study or employment in the sciences.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Thomas L. Naps USE 8851781
Lawrence University FY88 $35,043
Appleton, WI Computer Science

"Algorithm Visualization Laboratory"

This project utilizes a laboratory with graphics capabilities to display the effects of algorithms on data structures. Using animation, data structures are displayed as they are manipulated by algorithms so that students may understand the data structures and algorithms from a conceptual level apart from their representation in a particular language.

The algorithm visualization laboratory has six Macintosh II microcomputers participating in a local Appletalk network. One of the six systems serves as a gateway to an Ethernet network linking the Macintosh II's to the University's VAX 11-780 and MicroVAX. Most algorithm software development is done on the MicroVAX and then transmitted to the Macintosh computers for graphic display. The lab uses an overhead projection system capable of presenting an interactive Macintosh session on a large screen.

Real-time display allows the instructor to demonstrate concepts of algorithm performance and it allows students to experiment with algorithms and data structures on an individual basis - they learn about algorithms by watching them perform.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

William J. Perreault USE 8750525
Lawrence University FY87 $12,573
Appleton, WI Biology

"Equipment to Improve the Light Microscopy Program in Undergraduate Biology Laboratories"

A sophisticated light microscope is serving multiple functions within a Department which long has emphasized undergraduate training in microscopy. The basic instrument, a Zeiss model 16 phase contrast photomicroscope, is being used to train undergraduates interested in genetics, cytogenetics and microbiology. The addition of fluorescence capability plus a TV camera, monitor and videotape apparatus has transformed the basic microscope into a tool of enormous teaching and student research potential -- the fluorescence capability is supporting modern experiments in neurobiology and cell biology, while the television function is opening up access to detailed studies of the dynamics of living cells. The new laboratory facility is proving to be a superb teaching tool for small groups of students.

INFORMAL SCIENCE EDUCATION

Allen M. Young	MDR 8470568
Milwaukee Public Museum	FY85 $228,868
Milwaukee, WI	FY86 $187,350
	FY87 $163,750
	Biology

"Innovative Museum Biology Exhibit to Encourage Informal Learning on the Interrelatedness of all Life-Forms Including Humankind"

The Milwaukee Public Museum proposes to build an 11,000 square foot permanent exhibit using the American tropical rain forest as the core teaching and learning experience. The rain forest is host to a myriad of plant and animal species which took millions of years to evolve. Through the approximately 30 exhibits visitors will develop an understanding and appreciation of the diversity and interrelationships of the living world.

The exhibit developers have worked closely with the Milwaukee Public School system, which has resulted in the incorporation of this exhibit into the seventh grade curriculum. The exhibit is being designed to provide access for the physically handicapped.

The Museum reaches approximately 500,000 people annually. An additional two million people use its instructional materials. The NSF contribution is approximately 50 percent of the total budget.

COLLEGE SCIENCE INSTRUMENTATION

J. Timothy Petersik	USE 8750004
Ripon College	FY87 $5,814
Ripon, WI	Psychology

"Psychophysical Laboratories in Spatial Vision"

The primary goal of this project is to develop laboratories that will give students of psychology, psychobiology, and related health sciences hands-on experience with state-of-the-art equipment and procedures to understand recent advances in the theoretical and applied use of the "Fourier-analysis" hypothesis of spatial vision.

Under this project a visual-image synthesizer and small computer are requested so that laboratories involving psychophysical testing procedures with sine-wave grating stimuli can be developed. Students will learn to test human contrast sensitivity, to interpret the resulting contrast-sensitivity functions, and observe the effects of manipulating the conditions of testing. A set of demonstrations will be developed for use in non-laboratory oriented classes.

COLLEGE SCIENCE INSTRUMENTATION

Richard G. Scamehorn	USE 8851154
Ripon College	FY88 $21,000
Ripon, WI	Chemistry

"Fourier Transform Infrared Spectroscopy in the Undergraduate Curriculum"

Acquisition of a Fourier Transform Infrared Spectrometer is improving the instruction in Chemistry. The instrument replaced an aging dispersive IR spectrometer. Students are using a modern computer-controlled instrument which utilizes the Fourier transform method, which are two of the more important developments of the last few years. Two modern sampling accessories are extending the use of the IR to samples for which spectra previously could not be obtained. The instrument is being used in organic, physical, analytical, and advanced laboratory courses as well as in the undergraduate research program. Significant use in the non-majors courses is providing the non-science students with exposure to the power of computer search and spectroscopic techniques in identification and analysis of polymers and drugs.

The grantee is matching the award from non-Federal sources.

COLLEGE SCIENCE INSTRUMENTATION

Mary E. Williams-Norton	USE 8750024
Ripon College	FY87 $8,221
Ripon, WI	Physics

"Undergraduate Nuclear Physics Laboratory"

The Ripon College physics department will renovate its nuclear physics laboratory. A microcomputer and personal-computer-based analyzer will form the core of the new laboratory. Students of modern physics and nuclear physics will learn how to detect ionizing radiation in a variety of new detectors, amplify and shape the electronic signals with modern nuclear electronics modules, collect data under microcomputer control and analyze their results with the microcomputer system. An alpha spectrometer will give the students experience with solid-state detectors and vacuum systems and a new scintillation detector will be used for the detection of gamma rays. As the students use these systems, they will learn about the structure of nuclei, the interactions of ionizing radiation with matter and the many ways a microcomputer can be used as a laboratory instrument.

COLLEGE SCIENCE INSTRUMENTATION

James R. Hodgson	USE 8750735
Philip Cochran	FY87 $8,105
St Norbert College	Biology
De Pere, WI	

"Equipment to Support Undergraduate Instruction in Riverine Ecology"

A number of recent developments make it highly desirable for this institution to develop its capability to exploit the Fox River as a convenient outdoor laboratory for coursework and independent student research. Included among these are the approval of a new Environmental Science major, increased emphasis on aquatic research by faculty in the Biological Sciences, improvement in water quality and biotic diversity in the Fox River, and the relative inaccessibility of traditional terrestrial and small aquatic sites. (Although limited shore-based sampling was possible before the acquisition of the equipment provided in part through this grant, a lack of sampling gear appropriate for large riverine habitats prevented thorough use of the river.)

Acquisition of a versatile new boat-contained aquatic sampling system with capabilities for electrofishing and for making standard limnological measurements in large aquatic habitats effectively removes that barrier, making possible sound field-based laboratory experiences for undergraduates in this program.

COLLEGE SCIENCE INSTRUMENTATION

David L. Klopotek	USE 8750790
St Norbert College	FY87 $30,400
De Pere, WI	Chemistry

"Nuclear Magnetic Resonance Spectroscopy in Undergraduate Chemistry Instruction"

A nuclear magnetic resonance spectrometer has been acquired by the Chemistry Department of St. Norbert College for use in undergraduate instruction. The instrument is being used extensively in the following courses: organic, advanced organic, physical, instrumentation, biochemistry, and independent research. Experiments such as determining the pKa values of organic bases, measuring the percent enolization of acetylacetone, and the determination of coupling constants to distinguish between cis, trans, and geminal vinylic isomers are among the activities carried out. Students are provided with the hands-on experience expected by employers and graduate schools.

COLLEGE SCIENCE INSTRUMENTATION

Sharyl B. Peterson	USE 8750737
St Norbert College	FY87 $12,634
De Pere, WI	Psychology

"Microcomputer Based Psychology Student Research Laboratory"

The purpose of this project is to develop a microcomputer based psychology student research laboratory. Perhaps the most important research tool of contemporary psychology is the microcomputer, with its ability to present a variety of stimuli, and to collect subjects' responses to them. Thus, an important part of preparation for today's undergraduates must involve providing them with opportunities to learn to use microcomputers, to design, set up, and run psychological research, as well as to collect the data generated thereby, analyze it, and prepare their findings for communication with other scholars. The project is providing such learning experiences for psychology students across a spectrum of courses. Students are being introduced to basic procedures in their introductory courses, and to more advanced procedures in more advanced courses, including courses which specifically focus on principles and methods of research. Funding provided six APPLE microcomputers, peripheral hardware for Networking, and selected software to complement the software library.

COLLEGE SCIENCE INSTRUMENTATION

Robert J. Eierman	USE 8750810
University of Wisconsin Eau Claire	FY87 $12,807
Eau Claire, WI	Multidisciplinary

"Multidisciplinary Use of an Atomic Absorption Spectrometer in Undergraduate Chemistry and Geology"

The University of Wisconsin - Eau Claire will introduce the powerful analytical technique of atomic absorption spectrometry to chemistry and geology students at the undergraduate level. A flame atomic absorption spectrometer, including an electrothermal atomizer, will be acquired and installed in place of the present, obsolete instrument. The new instrument will be introduced and used in two chemistry laboratory courses, Quantitative Analysis and Instrumental Analysis. Applications will include comparison of this instrument with molecular absorption instruments and a simple analysis in Quantitative Analysis and a thorough familiarization and investigation of major instrumental parameters in Instrumental Analysis. Elemental analyses are critical to the geological sciences so it is necessary to teach this widely used technique. Atomic absorption analyses will be done in at least three geology courses including Geochemistry, Economic Mineral Deposits, and Chemical Hydrogeology. In addition, the instrument will be used extensively in research projects in both departments.

COLLEGE SCIENCE INSTRUMENTATION

Robert L. Hooper	USE 8851615
University of Wisconsin Eau Claire	FY88 $45,958
Eau Claire, WI	Geology

"Acquisition of an X-ray Diffractometer for Undergraduate Student Use"

The grantee will purchase an automated X-ray diffractometer, associated apparatus, and a computer for control of the instrument and analysis of the data. This equipment will be used to improve instruction in Introductory and Advanced Geology courses. In two lower-division courses X-ray diffraction techniques will be used for instruction in scientific methods and computer-assisted data reduction. In upper-division courses in Mineralogy and Geochemistry this equipment will be used to teach basic techniques of X-ray diffraction analysis.

The grantee will match the NSF award with an equal amount of funds.

TEACHER ENHANCEMENT PROGRAM

Sumner T. Scott	TPE 8652309
Philip A. Chute	FY87 $45,729
University of Wisconsin Eau Claire	Physics
Eau Claire, WI	

"Summer Workshop for High School Teachers of Physics and Physical Science"

This project will provide an opportunity for three weeks of concentrated study of electricity and magnetism for 30 Wisconsin high school teachers of physics and/or physical science. The schedule calls for lecture/discussion sessions as well as laboratory work. The instructional staff includes two university physics professors and one master teacher from a nearby high school; in addition, scientists from local industries will participate.

As part of the follow-up activities, the workshop director will visit the classrooms of the teacher participants during the spring following the summer workshop. In addition the participants will meet during the spring meeting of the Wisconsin Society of Science Teachers to discuss their experiences in implementing the new material covered during the workshop into their regular courses.

The evaluation plan calls for several different activities. First, the workshop will be visited and assessed by the Science Supervisor from the State Department of Public Instruction. Second, an opinion survey will be completed by participants near the end of the workshop. Third, the project director will assess the impact of the workshop on teaching practices during the on-site visits and the spring meeting. Finally, a questionnaire completed by participants during the academic year after the workshop will determine the extent to which ten specific project goals were achieved.

The dissemination plan will also be completed in four steps:

1) The project director will report results at a convention of the Northwest Wisconsin Education Association.
2) Reports will also be given at meetings of the Wisconsin Society of Science Teachers and the American Association of Physics Teachers.
3) The instructional materials used during the workshop, all developed locally specifically for this workshop, will be supplied to interested teachers on request.
4) Participants will be encouraged to write articles about the influence of the workshop on their teaching for professional Journals.

COLLEGE SCIENCE INSTRUMENTATION

David D. Riley	USE 8750820
University of Wisconsin La Crosse	FY87 $50,000
La Crosse, WI	Computer Science

"An Undergraduate Computer Aided Software Engineering Laboratory"

A computer aided software engineering (CASE) environment for first course students in computer science is being established. As CASE is already used in the industrial environment, this project will be unique in bringing it into the undergraduate environment. The CASE environment places increased importance on modularization, abstraction, team programming skills and the use of automated aids to software development. Ten Apollo workstations with associated mass storage elements will make up the environment. An important component of this project is the development of software modules and curricular materials for the integration of CASE equipment into the undergraduate environment.

COLLEGE SCIENCE INSTRUMENTATION

Michael R. Winfrey	USE 8750784
University of Wisconsin La Crosse	FY87 $47,310
La Crosse, WI	Biology

"Incorporation of Modern Molecular Techniques into the Undergraduate Microbiology Curriculum"

The Department of Biology and Microbiology is incorporating the methods of modern Molecular Biology and Biotechnology into the undergraduate Microbiology laboratory curriculum. The improvements are providing a strong background in classical Microbiology, as well as giving students hands-on experience with the techniques that have revolutionized Microbiology and other Biological Sciences in the last decade.

Centrifuges, spectrophotometers, electrophoresis equipment, and microcomputers are being used to implement major improvements in Bacterial Genetics and Bacterial Physiology laboratories. These changes ensure that the students receive modern instruction in the methods, principles and applications of DNA isolation, electrophoretic separation of DNA molecules and proteins, gene cloning techniques, DNA sequencing, and the use of computers to evaluate DNA molecules. Tissue culturing equipment is being used to instruct Immunology students in the fundamentals of cellular and humoral immunity and to provide them with experience in tissue culturing.

TEACHER ENHANCEMENT PROGRAM

Jerry A. Bell	TPE 8751276
Glen E. Dirreen	FY87 $1,149,970
University of Wisconsin	Chemistry
Madison, WI	

"Enhancing Interactive Teaching and Learning in the Precollege Classroom"

Through this award, the Institute for Chemical Education (ICE) will continue its work to enhance chemical education at all levels by fostering continuing professional growth and developing and disseminating creative "hands-on" teaching methodology. In this project, workshops evolved over the past three years will be given at five different field centers: University of Wisconsin, Madison (Glen E. Dirreen); University of Arizona (John V. Rund); University of California, Berkeley (Marjorie H. Gardner); University of Maryland (Jon M. Bellama); and University of Northern Colorado, Greeley (Henry W. Heikkinen).

The following activities will occur at one or more of the collegiate sites during the summer of 1987: Chemistry Fundamentals for teachers with minimal background; Chemistry Supplements for Pre-High School Classes for primary and middle/junior high school teachers to learn how to introduce science to younger children; Chemical Instrumentation to enrich the well qualified teacher's background in modern technological techniques. A total of 360 teachers will benefit from these varied programs.

Participants will conduct inservice out-reach activities for peers after the summer experience. During this phase of the ICE project, resource materials developed during the past several years will be edited and published for wide dissemination. Evaluation and assessment of the effects of the project will continue.

This project is noteworthy because of its national scope, the collaboration of several universities in addressing a national problem, the apparent success of prior activities supported by ICE, and the attempt to build a national network of precollege and college chemistry teachers to continue fostering excellent chemical education at all levels.

TEACHER ENHANCEMENT PROGRAM

Jerry A. Bell	TPE 8751837
Glen E. Dirreen	FY88 $1,040,419
University of Wisconsin	FY89 $1,163,671
Madison, WI	FY90 $ 220,788
	Chemistry

"Enhancing Interactive Teaching and Learning: Expanding Resources and Teacher Preparation"

This multifaceted program known as the Institute for Chemical Education (ICE) will continue its work to enhance chemical education at all levels by fostering continuing professional growth, developing and disseminating creative hands-on teaching methods and helping to strengthen the content background of chemistry teachers. Programs are being held at four campuses throughout the country: University of Wisconsin at Madison, University of Arizona, University of Maryland at College Park, and University of Northern Colorado.

Chemical Instrumentation Update Workshops will be given at three ICE Centers (UWI, UA and UMD) together with a fourth separately proposed at University of California at Berkeley. These workshops are designed to renew the enthusiasm of these selected teachers and provide them with a background in modern instrumental methods. An Instrumentation Loan program at the Arizona site will enhance this program.

A two-week Supplements Program will be held at each of three of the Centers (UWI, UMD and UNCO) with a fourth at UCB. This program will provide opportunities for elementary and secondary teachers to learn how to use demonstrations and hands-on activities in their classrooms. Science supervisors will be included as participants in this program to enhance the implementation of these activities in schools. Three community college and university colleagues will participate in order to develop programs which they may disseminate in their own locales.

The Chemistry Fundamentals Program is a longer program (six weeks at UWI and four weeks for each of two summers at UMD and UCB) designed to provide content background, laboratory activities and teaching strategies to teachers whose background is deficient in content and methodology.

Each component of the ICE activities can stand on its own merits, but the combination of activities provides a productive climate of interaction and collaboration.

RESEARCH IN TEACHING AND LEARNING

Elizabeth Fennema MDR 8550236
Thomas P. Carpenter FY85 $231,843
Penelope Peterson FY86 $299,868
University of Wisconsin FY87 $238,624
Madison, WI FY88 $199,620
Mathematics

"Studies of the Application of Cognitive and Instructional Science to Mathematics Instruction"

This project investigates how knowledge derived from instructional and cognitive science can be used to design instruction that enables children to learn mathematics more effectively, particularly at a higher cognitive level. A series of integrated studies examine the relationship of teachers' cognition and beliefs, mathematics instruction in first-grade classrooms, and children's learning of addition and subtraction skills, concepts, and word problems. The research methodologies are derived from cognitive science (e.g., individual interviews/semantic analysis of word problems, "thinking aloud") and from instructional science (e.g., process-product observational techniques). Two studies during the first year provided information on teachers' cognitions and beliefs. Instructional materials for teachers will also be developed during Year I. These materials will emphasize increasing teachers' knowledge so that they can create their own curricula. The teacher materials will include exemplary activities, assessment procedures, classroom organizational plans, etc., that teachers can both critique and use as models. During the second year, an in-depth instructional study will be conducted which involves formal and informal observations of 15-25 first grade teachers. Students' classroom behavior and teachers' instructional behavior will be observed. The focus will be on obtaining a detailed picture of teachers' beliefs and cognitive processes, the relationships of these to instructional behavior, and the effect of instructional behavior on children's cognitive processes and learning of mathematics. During Year III, the investigators will evaluate the effect of the curriculum on the children as they progress to second grade, intensively study the more effective teachers from Year II by clinical procedures, and revise the teacher education materials. During Year IV, the focus will be on analyses of research results, and on publication and dissemination.

This is a strong project that builds directly on the prior successful research of these investigators. It should advance our understanding of how teachers can be helped to acquire new knowledge of mathematics and mathematics learning by children and to use that knowledge to promote mathematics learning in their classrooms.

RESEARCH IN TEACHING AND LEARNING

Janet S. Hyde MDR 8709533
Elizabeth Fennema FY87 $218,926
University of Wisconsin Mathematics
Madison, WI

"Gender Differences in Mathematics Performance: Meta-Analysis and Cognitive Analysis"

There are now available more than 100 studies providing data on gender differences in mathematics performance, many of them having tested literally thousands of subjects. What is needed is a systematic, meta- analytic synthesis of the existing studies.

The objective of the research is to clarify the nature of gender differences in mathematics performance. A detailed meta-analysis of gender differences in mathematics performance,will address important and complex developmental and cognitive issues. In particular, the proposed project will provide answers to the following questions: (1) What is the magnitude of gender differences in mathematics performance, using the d metric? (2) "Mathematics achievement" is a general term encompassing a wide variety of tests, including simple tests of mathematics facts (addition, multiplication problems), word problems, geometry problems, calculus problems, and so on; does the magnitude of the gender difference vary on these different tasks, perhaps being close to zero on some and large on others? (3) Developmentally, at what ages do gender differences appear or disappear, and on which kinds of tests? (4) Combining Hedges' homogeneity statistics (Hedges, 1982, Journal of Education Statistics) with cognitive processing analysis, do males and females differ in some cognitive processes related to mathematics performance, but not on others? (5) To what extent do affective variables (such as confidence, anxiety, attributions, and so on) mediate the gender differences in mathematics performance?

The results of the research can make contributions to basic science by providing answers to the questions summarized above. In addition, the research has potential implications for mathematics education (and in turn for science and engineering education, insofar as they are dependent on mathematics education), particularly for sex equity in mathematics education.

TEACHER ENHANCEMENT PROGRAM

George M. Maxwell	TPE 8751812
Alfred L. Hampton	FY88 $169,909
Donald C. Woolston	Engineering
University of Wisconsin	
Madison, WI	

"Enhancements to AITIP Program for Teachers at Minority Schools"

Academic Industrial Teachers Internship Program focuses on the premise that if teachers know and understand, they will do a better job of directing students into the courses required to succeed in an engineering program.

For each of two summers, twenty-four high school teachers from minority schools nationwide will come to the University of Wisconsin for a two-week workshop and learn about engineering disciplines, engineering opportunities, and the correlation between engineering concepts and classroom instruction in mathematics, chemistry, and physics. A six-week internship will allow the participants to work side by side with engineers, technicians, and computer specialists.

This project offers the opportunity to specifically address several items of significance: the concern for increasing minority participation in the fields of engineering; the collaborative effort between industry and higher education; the need to better prepare teachers to counsel students into the proper mathematics, chemistry and physics courses; and the need to achieve a balance between the theoretical and the practical. This project can serve as a model of a kind of enrichment program for enhancing minority participation in science, mathematics, and engineering.

STUDIES AND ANALYSES

Thomas A. Romberg	OSPA 8550193
University of Wisconsin	FY85 $231,296
Madison, WI	FY87 $ 26,501
	Mathematics

"The Establishment of a School Mathematics Monitoring Center"

The purpose of this project is to provide supplemental funding for the continued support of the School Mathematics Monitoring Center at the University of Wisconsin - Madison for the period June 1, 1987 to August 21, 1987. The work to be accomplished involves the completion of two tasks which are currently being worked on by the staff of the Center. The first task, which is nearly complete, involves the final editing and production of Volumes II and III of a monograph being prepared on the monitoring of school mathematics. The second task will be to continue the examination of a set of tests, texts, and curriculum guides with respect to their coverage and emphasis on proportional reasoning.

INSTRUCTIONAL MATERIALS DEVELOPMENT PROGRAM

Paul H. Williams	MDR 8651604
James H. Stewart	FY87 $114,624
University of Wisconsin	FY88 $140,084
Madison, WI	FY89 $ 40,000
	Biology

""Fast Plant" Kits for Teaching Principles of Biology in K-12 Science"

"Fast Plant" kits will be developed around the rapid-flowering Brassica campestris, a "new plant technology", for use in K-12 science and biology classes. Approximately 20 hands-on exercises illustrating the basic concepts and principles of biology and genetics will be developed through the cooperation of teachers, scientists, and curriculum experts. Inquiry and problem solving through hypothesis testing will be an important focus of each exercise. Carefully designed to supplement the existing curriculum, the final product will be packaged into easy-to-use kits including seeds, watering system, teacher manuals, and student workbooks.

The rapid-cycling brassicas, members of the cabbage family, have unique properties which make them ideal classroom subjects: hardiness, petite size (eight fit into a coffee mug), rapid growth (complete seed-to-seed cycle in 35 days), and a wide variety of genes expressed as identifiable phenotypic characteristics.

This FY88 supplement will allow the project staff to respond positively to the requests for presentations and to produce more copies of the materials for teachers asking to use them.

Two important components of this project which make it valuable to precollege education, especially elementary, is that plants are familiar to these teachers and they are not shying away from its use. Secondly, an eminent research scientist is deeply involved in trying to improve precollege science education: this is resulting in a program with high credibility with respect to the scientific content, and is serving as a model for other research scientists.

TEACHER ENHANCEMENT PROGRAM

Shirley S. Williams	TPE 8552396
Kenneth W. Dowling	FY 86 $691,416
University of Wisconsin	FY 88 $247,179
Madison, WI	HS Science

"Wisconsin Science Education Service Center"

The Board of Regents of the University of Wisconsin System is embarking on a comprehensive plan for the in-service education of teachers of elementary, middle, and high school through the establishment of Science Education Service Centers at three campuses of the University of Wisconsin. The Wisconsin Department of Public Instruction will cooperate to develop a network of these model science education service centers that will be designed to meet the diverse needs of science teachers from all parts of the state. The three initial center sites chosen represent different population profiles: (1) an urban corridor where the minority population is highest, (2) a medium-sized city area that has both an agricultural and industrial dependence with the highest concentration of native Americans in the state, and (3) a low-density population mostly dependent on agriculture which has attracted a large concentration of Hmong immigrants.

In the first year, the University of Wisconsin-Green Bay and UW-Milwaukee Centers will provide in-service courses and activities for 75 high school teachers and 40 middle school teachers, respectively. In the second year, the UW-LaCrosse Center will begin operating--along with the continuation of the other two centers--for the benefit of 50 elementary school teachers. All three centers will continue to operate at this level in years three and four. Programs at each of the sites include appropriate content courses, laboratory-based activities, and a structured follow-up schedule insuring support for these participating teachers. A network of representatives from these three sites, as well as from other UW campuses, will function as an advisory committee to this project. This network will also serve as an initiator for similar centers at additional campus sites throughout the state.

YOUNG SCHOLARS

Ruth Williams	RCD 8850248
Rose M. Daitsman	FY88 $48,973
University of Wisconsin Milwaukee	FY89 $48,973
Milwaukee, WI	Life Sciences

"University of Wisconsin-Milwaukee Young Scholars Project"

Twenty 9th grade students will participate in a six-week summer program made up of one-on-one laboratory training and project development; classes in scientific ethics, problem solving, and career exploration; orientation and participation in museum science; and field trips to industrial, medical, and university laboratories and research sites. Follow-up activities during the school year and subsequent summer are also part of the project. Key components of the UWM Young Scholars Program are: (1) the joint participation of the Milwaukee City Museum in presenting this program; (2) the commitment of ten key research faculty from UWM and five from the Milwaukee Public Museum to participate as faculty mentors in the Young Scholars Program; and (3) the availability of continuing research activities for the young scholars in subsequent summers through the university's high school apprenticeship programs and local industrial internships.

COLLEGE SCIENCE INSTRUMENTATION

David G. Blanchard	USE 8750534
University of Wisconsin Oshkosh	FY87 $16,995
Oshkosh, WI	Economics

"Simulation of the National Economy for Macroeconomics Classes"

This project provides a computer lab for students which will enable them to experience the impact on the national economy of various changes in national policy. The Department of Economics at the University of Wisconsin Oshkosh is extending its strategy of providing computer simulations of economics in its core courses to its macro principles and intermediate macro theory sections. Using a high quality spreadsheet and the fine resolution of the Apple Macintosh computer, student imputed changes impact the simulated economy. The software and department-developed templates provide an easy way for students to record both the numerical impact and graphic illustration of their policy changes.

COLLEGE SCIENCE INSTRUMENTATION

Timothy F. Crimmins	USE 8750071
University of Wisconsin Oshkosh	FY87 $22,250
Oshkosh, WI	Chemistry

"Fourier Transform Infrared Spectroscopy in the Undergraduate Chemistry Laboratory Curriculum"

A Fourier Transform Infrared Spectrophotometer (FTIR) is being used by the Chemistry Department of the University of Wisconsin-Oshkosh to introduce chemistry students to the infrared techniques of data acquisition and manipulation, spectral storage, searching, and signal enhancement. This is being accomplished by introducing several new laboratory experiments, updating existing ones and offering expanded opportunities in undergraduate research. This curriculum development is having a direct impact on the physical chemistry, instrumental, inorganic, and spectroscopy laboratories and will significantly update the training of students in the area of Infrared Spectroscopy.

COLLEGE SCIENCE INSTRUMENTATION

John H. Karl	USE 8750800
University of Wisconsin Oshkosh	FY87 $16,258
Oshkosh, WI	Physics

"A Computer Graphics Workstation for Digital Signal Processing In Undergraduate Physics and Geophysics"

The University of Wisconsin Oshkosh has integrated an important type of computing called digital signal processing, or DSP into its academic programs. The technique is used to extract information from data in fields such as geophysics, astronomy, meteorology and medicine. Currently DSP is practiced at UW Oshkosh in three different academic programs: physics, computer science and geophysics. Support from the National Science Foundation, matched by UW Oshkosh funds, will be used to purchase a graphics computer workstation, consisting of a Digital Equipment Corporation MicroVax graphics workstation, so that students learning DSP can practice with problems of real-world size and complexity. In addition, data from experiments such as acoustic imaging within the earth, or magnetic resonance data, will be analyzed as part of student projects.

COLLEGE SCIENCE INSTRUMENTATION

John H. Karl	USE 8852033
University of Wisconsin Oshkosh	FY88 $22,437
Oshkosh, WI	Geology

"An Integrated Instrumentation Package for Undergraduate Seismology"

The grantee will purchase a 24-channel digital floating point seismograph, and an associated microcomputer. This instrumentation will be used to improve instruction in undergraduate courses in Geophysics, Geological Exploration, Engineering Geology, Hydrology, and Environmental Geoscience by introducing students to the use of seismic techniques in these areas. In addition the instruments will be used for independent projects by undergraduate students. This project involves a collaborative effort between the physics department and geology department at UW, Oshkosh.

The NSF equipment grant will be matched by an equal contribution by the grantee, plus an additional 39% in summer salary support.

COLLEGE SCIENCE INSTRUMENTATION

Robert L. Williams	USE 8750560
University of Wisconsin Oshkosh	FY87 $11,774
Oshkosh, WI	Biology

"Undergraduate Laboratory Instrumentation for Biotechnology"

This Department has initiated a series of courses with emphasis in Biotechnology. The new fermentation equipment purchased through this grant is making it possible to offer laboratory components of these courses. One 7.5-liter fermenter and two 2-liter fermenters are updating and supplementing existing equipment used in the Biotechnology- related courses, allowing introduction of current fermentation and chemical engineering techniques. This equipment also will be made available to students conducting undergraduate research.

The new equipment helps students acquire hands-on experience with scientific equipment they may encounter as they go on to advanced studies or to employment in Microbiology-, Biology- or Chemistry-based careers.

PRIVATE SECTOR PARTNERSHIPS

Joseph S. Balsano	TPE 8751686
Esther M. Letven	FY88 $224,890
Olivia A. Andrea	FY89 $225,110
Chester H. Melcher	Elem Science
John B. Welch	
University of Wisconsin Parkside	
Kenosha, WI	

"Partnership of Industry and Education to Improve Elementary Science Instruction"

A partnership of school, university, and industry people will carry out a multipronged program to demonstrate how elementary science education can be strengthened through a well designed cooperative effort. Elements of the program are:

A Science Resource Network of industrial scientists will be created to support elementary teachers in a variety of ways.

Elementary teacher Science Specialists will work with each school to demonstrate various models of science teaching.

Science-weak elementary teachers will be able to volunteer as Science Fellows for special training programs to overcome those weaknesses.

Permanent Elementary Sciences Alliances of elementary teachers, other school and industry people, and university professors will be formed to provide a reinforcing mechanism for the elementary teachers.

A program of incentives and awards will be established to recognize exemplary elementary science teaching.

The partnership will undertake appropriate science education advocacy activities.

The goal of the project is to demonstrate how a comprehensive community-supported program can lead to major improvements in elementary science teaching.

Cost sharing by the partners will total a minimum of 23 % of the NSF funding.

COLLEGE SCIENCE INSTRUMENTATION

Timothy V. Fossum USE 8852826
University of Wisconsin Parkside FY88 $30,225
Kenosha, WI Computer Science

"Microcomputer Networks/Operating Systems Laboratory"

This project incorporates an integrated microcomputer systems development configuration into an operating systems laboratory. The laboratory is used to teach implementation-oriented courses in Introductory Operating Systems, Advanced Operating Systems and Networks.

The equipment that supports this project includes nine Zenith microcomputer systems, three printers, and network hardware to connect to an existing VAX computer system.

The project provides students with practical knowledge and experience with operating systems and computer networks, skills that prepare students to function effectively as systems software engineers.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Peter A. Nielsen USE 8750162
University of Wisconsin Parkside FY87 $34,687
Kenosha, WI Multidisciplinary

"Acquisition of X-ray Powder Diffraction Facilities and Upgrading of the Undergraduate X-Ray Scattering Laboratory"

Under this project, a Huber powder goniostat and countertube attachment, and a Rigaku D/max IIIVB X-ray generator with vertical goniometer mount will be purchased. This instrumentation will serve the broad purpose of teaching geology, physics, and chemistry undergraduate students the fundamentals of photon counting and signal processing, interfacing of instruments to computers, and X-ray crystallographic techniques. It is our perception that undergraduate programs in geology, physics, and chemistry in general suffer from inadequacy in the teaching of instrument interfacing, computer simulation, and structure determination. All of these aspects of experimentation are important to the education of undergraduate geologists, physicists, and chemists so they can pursue graduate studies or obtain meaningful employment. The requested equipment will be used in mineralogy, petrology, soils, glacial geology, environmental geology, physical chemistry, chemical instrumentation laboratories and in selected independent studies and senior thesis research projects in geology, physics, and chemistry.

COLLEGE SCIENCE INSTRUMENTATION

Swaminathan Balachandran USE 8851559
University of Wisconsin FY88 $62,000
Platteville, WI Mechanical Eng

"Enhanced Computer Integrated Manufacturing Laboratory"

The quality of undergraduate Engineering education at this institution is improved through the acquisition of state-of-the-art Computer Integrated Manufacturing (CIM) equipment. An already existing CIM laboratory is enhanced through the addition of a pneumatic robot, an automated storage and retrieval system, loop conveyor, programmable conveyor, CNC mill, servo robot controller, vision system, bar code reader, computer interfaces and associated software.

This enhanced laboratory permits the teaching of CNC machine programming, application of vision in manufacturing, principles of programmable logic controllers, integration of materials handling in manufacturing, local area networking, and human aspects of automated manufacturing.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Thomas E. Holland, Jr. USE 8851558
University of Wisconsin FY88 $18,405
Platteville, WI Industrial Eng

"Statistical Process Control Laboratory"

The equipment dedicated to this project supports the integration of Statistical Process Control (SPC) into the undergraduate Industrial Engineering Manufacturing Laboratory at this institution. Students perform hands-on experiments in SPC techniques in a real-time data collection environment to gain expertise in both manufacturing and the automation of SPC.

The equipment that supports this project includes: digital measuring instruments to measure dimensions of parts as quality characteristics; data collection and transmission devices to collect or transmit data from gages to the microcomputers; microcomputers to process the real-time data; peripheral devices to produce control charts and reports; and, SPC software that analyzes quality information in real time.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Lang W. Lee USE 8851683
Tamer Ceylan FY88 $14,440
University of Wisconsin Mechanical Eng
Platteville, WI

"Instrumentation for a Wind Tunnel"

This project improves on this institution's already existing wind tunnel laboratory setup. Undergraduate students using this enhanced lab gain experience with leading-edge aerodynamic measurement techniques. The enhanced wind tunnel laboratory includes a sting balance, a two- dimensional traversing mechanism, a Scanivalve pressure scanner and synchro transmitter-slipring unit. This equipment is interfaced to computers permitting students to study external flow phenomena associated with stationary or rotating objects.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Piyare L. Sharma USE 8851439
University of Wisconsin FY88 $26,000
Platteville, WI Electrical Eng

"Equipment Acquisition for Digital Control Laboratory"

This project enhances the digital controls offerings at this institution. Using the laboratory funded by this award, undergraduate electrical engineering students study theoretical and practical principals of automatic controls, discrete time control systems and digital signal processing. The equipment supporting this lab includes: TMS32010 Evaluation Modules with analog interface boards, macro assembler/linker, simulators, Hitachi V-1100A oscilloscopes, IBM PS/2 PC's and Epsom printers.

This award is being matched by an equal sum from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Curtiss O. Larson USE 8750111
Earl Blodgett FY87 $11,960
University of Wisconsin River Falls Physics
River Falls, WI

"The Incorporation of Fundamentals of Ultrasonic Materials Characterization into the Undergraduate Physics Curriculum"

Upper division physics majors will have the opportunity to learn the fundamentals of ultrasonic acoustics and ultrasonic characterization of materials. Increasing concern with both product quality and cost has resulted in a demand for more nondestructive evaluation of materials. Students in two upper division laboratories and in senior seminar projects will use a high resolution, microcomputer controlled mechanical scanner to develop a solid understanding of ultrasonic propagation. In addition to measurement of fundamental acoustic parameters such as group velocity and attenuation, students may examine the frequency dependence of the phase velocity or the spatial distribution of energy in an interrogating ultrasonic beam. Students will learn about ultrasonics and materials in particular, and they also will have the opportunity to do experiments which deal with the fundamental properties of any kind of waves.

COLLEGE SCIENCE INSTRUMENTATION

Thomas Detwyler USE 8852094
University of Wisconsin FY88 $41,140
Stevens Point, WI Geology

"An Interactive Videodisc Laboratory for Teaching Introductory Undergraduate Earth Sciences"

The grantee will purchase 12 interactive video disc learning stations and an image capture/processing system. The learning stations will be used to improve laboratory instruction in four introductory Geography and Geology courses serving approximately 5,000 students per year. Interactive video disc technology will be used to complement conventional instruction by providing tutorials, exercises, simulated field trips, modelling, slow-and accelerated-motion studies, etc. Both existing and newly authored materials will be used. The image capture/processing system will be used to prepare new video disc materials. The project builds on substantial pilot work carried out by the project director.

The grantee will match the NSF award with an equal amount of funds.

YOUNG SCHOLARS

Francis G. Florey	RCD 8850188
Thomas P. Markee	FY88 $49,362
Mary D. Balcer	FY89 $49,362
Mary J. Sullivan	Environmental
Albert B. Dickas	
University of Wisconsin Superior	
Superior, WI	

"Modeling Acid Deposition: An Introduction to Scientific Methods"

This Young Scholars Program brings sixteen secondary students to the University of Wisconsin-Superior during the summer for a six-week program that acquaints them with the scientific methods involved in studying acid deposition. Classroom presentations introduce students to 1) the sources of atmospheric pollutants, 2) the chemistry of acid deposition and 3) the effects of acidification on terrestrial and aquatic ecosystems. The participants gain skills in collecting and analyzing chemical and biological data through a series of field trips and laboratory experiments. The program also stresses the role of mathematical modeling in solving scientific problems.

The students use techniques of exploratory data analysis and multiple linear regression to examine data collected by the National Atmospheric Deposition Program. Participants use the data to construct their own model for predicting the pH of acid precipitation and prepare a 30-minute program on their work for presentation at their high schools. This summer program is multidisciplinary in nature and exposes participants to a variety of careers in science and mathematics and enables them to determine the training required for each.

TEACHER ENHANCEMENT PROGRAM

Mary J. Sullivan	TPE 8751349
University of Wisconsin Superior	FY87 $37,392
Superior, WI	Physics

"Application of Electronics to Teaching High School Physics and Computer Science"

This project will bring twenty-five high school physics and computer science teachers from the state of Wisconsin to the University of Wisconsin-Superior during the Summer of 1988 to participate in a two-week workshop on electronics to better prepare them to teach high school physics and computer science. Teachers selected for the program will learn concepts in basic and advanced electronics including electronics as it applies to the microprocessor. A significant portion of the workshop will be devoted to the development of strategies and materials for use by the teachers in their classrooms. In addition, participants will be able to choose self-paced modules in specialized areas of electronics in which they way want to develop a better understanding. The teachers will be expected to develop an electronics project to assist their teaching. This project will be utilized in their classroom during the following school year and the results of its effectiveness will be determined. A teacher's guide of classroom strategies will be developed by the participants in a follow-up seminar to be held in the winter of 1988-1989. This guide will be available to 19 CESA agencies in the state of Wisconsin and will be distributed to the Wisconsin Society of Science Teachers. Copies will be sent to the Department of Public Instruction in each state office.

COLLEGE SCIENCE INSTRUMENTATION

Stuart M. Glosser	USE 8852274
University of Wisconsin Whitewater	FY88 $72,714
Whitewater, WI	Economics

"Economics Computer Laboratory"

This project establishes an Economics Computer Laboratory. The laboratory enables the department to incorporate the computer into its undergraduate curriculum and thus enhances the ability of the students to conceptualize the essence of economic and empirical techniques. The award provides adequate capacity to absorb large classes such as Introductory Statistics, takes advantage of recent developments in object oriented languages, relational data bases, and integrated applications, as well as user friendly environments developments that will help the student conceptualize the substance of the course material. Thirty one MacIntosh II's along with related peripheral equipment and software are provided. All students in the Introductory Statistics class can now take a computer laboratory course in statistics. In addition, by taking advantage of recent software developments, the computer laboratory is used as a tool to enhance students' understanding of important economic and, especially, empirical concepts.

The award will be matched by an equal amount from the grantee.

COLLEGE SCIENCE INSTRUMENTATION

Dennis M. Richter	USE 8750740
University of Wisconsin Whitewater	FY87 $15,775
Whitewater, WI	Geography

"Computer Graphics for Geographic Analysis and Problem Solving"

The purpose of this laboratory instrumentation project is to improve and increase computer usage in statistical analysis and graphics applications in upper division (major and minor program) geography courses. Students will have the opportunity to access large data bases, perform more sophisticated statistical analyses, and produce maps, graphs, and charts in a much less time consuming manner. This will allow more time for material research and report writing, as well as encouraging additional in-depth data analysis and graphic presentation. The proposal will continue the computer applications upgrading begun by the Department in the middle 1970's as part of an ongoing effort at affording geography students the best education possible within the discipline with regard to both personal enrichment and career opportunities.

COLLEGE SCIENCE INSTRUMENTATION

John J. Ruffolo	USE 8750803
University of Wisconsin Whitewater	FY87 $28,551
Whitewater, WI	Biology

"Equipment to Facilitate Undergraduate Laboratory Investigations in Cellular Biology"

The project is improving the quality of the laboratory part of a course in Cellular Biology. The laboratory experience is acquainting Biology majors with such modern experimental and analytical techniques of Cell Biology as microscopy, tissue culture, cytological, cytochemical, and labeling methods, methods of cell fractionation (esp. centrifugation), and methods of molecular analysis (esp. electrophoresis). The equipment for this project falls into three categories -- microscopy, centrifugation, and electrophoresis: phase-contrast compound microscopes for observing living cells, phase-contrast inverted microscopes for observing tissue cultures, a fluorescence accessory to detect fluorescent stains and labeled antibodies and a video accessory to facilitate group observations, a tabletop ultracentrifuge for cell fractionation, a micro-centrifuge for molecular techniques, and electrophoresis systems for the analysis of proteins and nucleic acids.

Instead of depending on demonstrations, all students now can be exposed to a more realistic atmosphere of experimental science that encourages originality and the cultivation of research and problem solving skills. Such experience is particularly valuable for students who are planning to enter graduate school, and those who are planning to become Biology teachers.

COLLEGE SCIENCE INSTRUMENTATION

Mary C. Hassinger	USE 8852192
Viterbo College	FY88 $18,636
La Crosse, WI	Chemistry

"Instrumentation for Improving Undergraduate Instruction in Gas Chromatography"

Gas Chromatography (GC) is being integrated across the curriculum with the concepts, practice and specialized uses of modern separations technology being employed. Significant improvement in the laboratory component of the curriculum is resulting with the introduction of both general purpose and research grade GC instruments. Three general purpose GC instruments have been purchased in order to introduce chromatography concepts to General Chemistry students. They are being used as an integral part of sample analysis in the Organic Chemistry laboratory and as a quantitative analysis tool for the Analytical Chemistry laboratory. A research grade capillary GC coupled with a chromatography workstation and a purge and trap analyzer has been purchased for use in the Advanced Analytical and Organic, Physical, Inorganic, and Individual Research courses. Efficient GC separations, computer collection and manipulation of data, and the ability to study a wide variety of samples utilizing purge and trap techniques is allowing new, relevant laboratory experiences to be offered to Chemistry majors, and is enhancing student research capabilities.

The grantee is matching the award from non-Federal sources.

TEACHER ENHANCEMENT PROGRAM

LeRoy R. Lee	TPE 8751345
Forest W. Stearns	FY88 $193,699
Wisconsin Academy of Sciences, Arts and Letters	Geology
Madison, WI	

"Leadership Development for Middle/Junior High School Teachers"

This three-year project initiates a long-range plan of the Wisconsin Academy Center for the Advancement of Science Education (CASE) to develop leadership among Wisconsin's middle/junior high school science teachers and to increase the quality and quantity of field experiences provided students in grades

7-9. The project's major components include: developing increased subject matter competence in field ecology and field earth science; participant development of local field experiences; and developing leadership skills and applying these skills in local community and state-wide professional activities. An active support network will be established among participants and between participants and scientists. Sixty middle/junior high school earth science and life science teachers will be selected over the three-year period, representing 25% of Wisconsin middle/junior high schools.

Subject matter will be provided through seminars, workshops, and field experiences led by university, government, and industrial scientists. Participants will have field experiences in the major geological and vegetational provinces of Wisconsin as well as their local area. Current environmental issues will be discussed.

Leadership development will be addressed through discussions, readings, and seminars. Stress will be placed on strategies to implement change. Through development of field-based curricular models, participants will be introduced to the process of curriculum development. They will be expected to provide leadership in their districts as local schools develop a science curriculum to meet the new state guidelines.

Participants will apply leadership skills and subject matter knowledge during the project. Each participant will be expected to: conduct local field experiences for their students as part of the curriculum; provide an inservice field experience for elementary teachers and principals; conduct a field experience for community adults; assist their school in local curriculum development; and present a professional paper at a local or state meeting. In addition, each participant will work with master teachers as those teachers work with students and/or teachers in summer programs.

INSTRUCTIONAL MATERIALS DEVELOPMENT

Nancy Bauer MDR 8652321
Wisconsin Public Television Network FY87 $416,576
Madison, WI Other NEC

"Secondary Grades Science/Technology/Society Project"

Wisconsin Public Television Network (WPTN) will develop the Science/Technology/Society (S/T/S) project which will emphasize the presentation of scientific concepts in a context of real-world problems that are social/technical in nature, in order to teach the mutual dependence of science and society. The pilot phase of the project was partially funded by NSF. This proposal will work towards the completion of the Secondary Grades Science S/T/S Project whose design is to enable teachers to incorporate essential instruction about the interrelatedness between science/technology/society in secondary grades curricula. The project includes production and evaluation of classroom video and computer materials for students and of video programs for in-service teacher training accompanied by printed materials. The video programs will use the facilities of WHA-TV in Madison, Wisconsin.

The project will draw on the skills of specialists in the design and creation of instructional media, subject-matter experts, and other educators. The project director, Nancy Bauer, will coordinate the efforts of these individuals, the agencies, and organizations they represent.

This project is partially funded by the Directorate for Geosciences.

WYOMING

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Jennifer Grooms
Science
Kelly Walsh High School
Casper, WY

Princess Killebrew
Mathematics
Wyoming Indian Middle School
Ethete, WY

1988

Carol Born
Mathematics
Lander Valley High School
Lander, WY

David Masterman
Science
Jackson Hole High School
Jackson, WY

TEACHER PREPARATION PROGRAM

Patricia McClurg
University of Wyoming
Laramie, WY

TPE 8851105
FY88 $199,071
FY89 $235,930
FY90 $163,083
FY91 $ 85,224
Elem Science

"An Experimental Teacher Education Program in Elementary Science"

The University of Wyoming will implement a new teacher preparation program for prospective elementary teachers in the state. A major feature of this project will be the development of three new sequential, five-hour, introductory science courses that will be required for elementary education majors and appropriate for other nonscience majors. These courses will be developed by teams of scientists from the biology, chemistry, physics, and geology departments around integrating themes. Many of the accompanying laboratory experiments in each course will use a learning cycle approach. Other features of the new program are seminars for the preservice elementary teachers on teaching methodology that will focus on cooperative learning and the learning cycle approach, and early and continuous field experiences. By scheduling the field experiences and seminars concurrently with the science courses, prospective teachers will be given the opportunity to adapt the science presented in the introductory science courses to the teaching of science in the elementary schools. The project also includes workshops for preparing mentor teachers who will use both cooperative learning and the learning cycle approach in their elementary school classrooms, and who will be observed by the prospective teachers during their early field experiences.

The University of Wyoming will participate in sharing 13.5% of the cost of the project.

DEPARTMENT OF DEFENSE DEPENDENT SCHOOLS

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Dan D. Holmquist
Science
Frankfurt American High School
APO New York, NY

Nancy L. Hill
Mathematics
Seoul American High School
APO San Francisco, CA

U.S. TERRITORIES

Presidential Awards for Excellence in Science and Mathematics Teaching

1987

Sheila Muniappan
Science
George Washington Senior High School
Barrigada, Guam

Guadalupe C. Sabino
Mathematics
Hopwood Junior High School
Saipan, Marianas

INTERNATIONAL

PROGRAM ASSESSMENT

David Thomas OSPA 8850592
Organization For Economic Coop and Development FY88 $87,600
Paris, FR Other NEC

"Project on Curriculum Development in Science, Mathematics and Technology in Industrialized Democracies"

This proposal is for two international conferences to exchange information on the status of curriculum reform in science, mathematics, and technology education among industrialized nations. At least twenty nations will be involved in the OECD meetings.

APPENDICES

Appendix A : Graduate Fellowship Awards

Appendix B : Minority Graduate Fellowship Awards

Appendix C : NATO Post-Doctoral Fellowship Awards

Lists of fellowship recipients include only those individuals receiving first-time support in FY87 and FY88.

APPENDIX A
GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY87

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Abbott, James Russell	CA	Univ of Cal - Davis	Chemical Engineering	Mass Inst Tech
Ackerly, David Dickinson	MA	Yale University	Ecology	Harvard Univ
Allendoerfer, Karen Lona	NY	Princeton University	Neuroscience	Stanford Univ
Amenta, Annamaria B	PA	Yale University	Computer Science	U Cal Berkeley
Ammer, John M	MA	Yale University	Economics	Princeton Univ
Andrews, Thomas O	IL	Yale University	Math / Topology	Mass Inst Tech
Apperson, K Denise	TX	University of Texas	Geophysics	UCLA
Asomaning, Margaret E	OH	Harvard University	Biology/Environmental Sci	Imperial Coll ENG
Aspinwall, Lisa G	WA	Stanford University	Psychology/Sociology	UCLA
Aspnes, James David	NJ	Mass Inst Technology	Computer Science	Mass Inst Tech
Atkins, Robert George	MA	Mass Inst Technology	Electrical Engineering	Mass Inst Tech
Axen, Gary James	AZ	Mass Inst Technology	Geology	Mass Inst Tech
Bace, Matthew Mark	IL	Mass Inst Technology	Electrical Engineering	Mass Inst Tech
Baker, Andrew B	NJ	Harvard University	Computer Science	Stanford Univ
Bakken, Andrew Peter	CO	Colorado State Univ	Chemical Engineering	Univ of Wisconsin
Barker, Timothy Wayne	AZ	University of Utah	Meteorology	Univ of Utah
Barrett, Robert C	VA	Washington Univ/Mo	Solid State Physics	Cal Inst Tech
Barrow, Mark Velpeau, Jr	FL	University of Florida	History of Science	Harvard Univ
Bashkow, Ira Robert	NY	Harvard University	History of Science	Univ of Chicago
Basu, Susanto	MA	Harvard University	Economics	Harvard Univ
Baughman, John F	MA	Harvard University	Biology	Stanford Univ
Baum, Larry William	CA	Harvard University	Neuroscience	U Cal San Diego
Beaulieu, John Joseph	MI	University of Michigan	Economics	Harvard Univ
Becker, Penny Ann Edgell	OH	Princeton University	Sociology	Harvard Univ
Beer, Jennifer E	DE	Earlham College	Anthropology	U Cal Berkeley
Beiring, Elizabeth A	NY	SUNY at Buffalo	Experimental Psychology	Mass Inst Tech
Belanger, Kristiann Mary	MI	Purdue University	Genetics	J Hopkins Med
Benson, Ronald G	CO	University of Colorado	Electrical Engineering	U Cal Berkeley
Berera, Arjun	CA	Univ Calif Berkeley	Theoretical Physics	U Cal Berkeley
Berkenblit, Scott Ira	NY	Mass Inst Technology	Bioengineering	Mass Inst Tech
Berkowitz, Ari	IL	University of Chicago	Neuroscience	Stanford Univ
Bertozzi, Andrea Louise	MA	Princeton University	Mathematics Applications	Princeton Univ
Beutner, Thomas John	IN	Purdue University	Aeronautical Engineering	Stanford Univ
Beyler, Richard H	KS	Goshen College/IN	History of Science	Harvard Univ
Bienias, Julia Louise	IL	Washington Univ/MO	Psychology/Sociology	Univ of Illinois
Biolsi, Kevin John	MO	Cornell Univ	Experimental Psychology	Univ of Michigan
Bix, Amy Sue	IL	Princeton Univ	History of Science	Johns Hopkins U
Blanchette, Joan Teresa	WA	Washington State Univ	Biochemistry	Cal Inst Tech
Blum, Avrim Louis	CA	Mass Inst Technology	Computer Science	Mass Inst Tech
Blumenthal, Edward M	IL	Cornell University	Neuroscience	J Hopkins Med Ins
Bodenbender, Brian E	OH	College of Wooster/OH	Paleontology	U Cal Berkeley
Bolce, Margaret E	OH	Cornell University	Molecular Biology	U of Washington
Bone, Douglas John	SC	Clemson University	Electronic Engineering	Stanford Univ
Bonwick, Jeffrey Stewart	NJ	University of Delaware	Mathematics/Statistics	Stanford Univ
Booth, Susan Drummond	MD	Yale University	Fish and Wildlife	U of Minnesota
Borkowski, Jeffrey Alan	IN	Univ of Notre Dame	Nuclear Engineering	Penn State Univ
Bowman, Contee Stansbury	DC	Princeton University	Fluid Physics	Princeton Univ
Brainard, Michael S	CT	Harvard University	Neuroscience	Stanford Univ
Brown, Jacqueline P	NY	Hunter College-CUNY	Anthropology	Univ of Michigan
Budlong, Bradley James	OR	Oregon State Univ	Electrical Engineering	Stanford Univ
Bull, Kristie Ann Boring	CA	U California-San Diego	Physical Chemistry	Stanford Univ
Bull, Laura Nanine	IL	Yale University	Biochemistry	U Cal Berkeley
Busch, Ingrid Karin	MI	Hillsdale College/MI	Mathematics/Ops Research	Johns Hopkins U
Bushong, Philip Merton	TX	Texas A&M University	Aeronautical Engineering	Texas A&M Univ
Callon, Scott	CA	Princeton University	Political Science	Harvard Univ
Calvi, Brian Richard	CT	Univ of Connecticut	Cellular Biology	Mass Inst Tech
Cannell, Barbara A Lerch	NY	Keene State College/NH	Botany	U Mass Amherst
Cano, Manuel Luis	FL	Univ of Notre Dame	Chemical Engineering	Mass Inst Tech
Cappaert, David Lawrence	MI	Michigan State Univ	Entomology	Mich State Univ
Capps, G George	TX	University of Texas	Microbiology	Univ of Texas
Carey, David Brennan	OR	Lewis & Clark Coll/OR	Zoology	U of Washington
Carroll, Lisa	PA	Univ of Pennsylvania	Experimental Psychology	New York Univ
Carroll, Mary Katherine	NY	Union University/NY	Analytical Chemistry	Indiana Univ
Carter, Kay L Steibel	WI	Univ of Wisc Parkside	Inorganic Chemistry	U Wisc Milwaukee
Cartwright, Craig L	FL	Mass Inst Technology	Mechanical Engineering	Stanford Univ

APPENDIX A
GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY87

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Caulkins, Jonathan P	NY	Washington Univ/MO	Electronic Engineering	Harvard Univ
Chafee, Matthew V	VT	Oberlin College/OH	Neuroscience	Yale Univ Sch Med
Chan, Clara Sophia	VA	Harvard University	Mathematics /Analysis	U Cal Berkeley
Chanen, David Ari	IA	Mass Inst Technology	Computer Science	Mass Inst Tech
Chang, Bay-Wei W	PA	Princeton University	Bioengineering	Mass Inst Tech
Chen, Peter Ming-Chien	PA	Penn State University	Electrical Engineering	Univ of Illinois
Chervenak, Ann Louise	CA	Univ of Southern Calif	Electrical Engineering	U Cal Berkeley
Chin, Douglas Andrew	TX	University of Texas	Mathematics/Algebra	U Cal Berkeley
Chirichella, Joanne	NY	Polytechnic Univ/NY	Civil Engineering	Stanford Univ
Cho, Peter Leslie	CA	Cal Inst Technology	Theoretical Physics	Mass Inst Tech
Christian, Andrew Dean	MI	Univ of Michigan	Mechanical Engineering	Stanford Univ
Chu, Charleen Tan-Ching	CA	Harvard University	Neuroscience	Stanford Univ
Cline, David William	MO	Univ of Missouri Rolla	Electronic Engineering	U Cal Berkeley
Cobb, Charles Gary	FL	Tufts University	Cellular Biology	Cornell Univ
Cohen, Jonathan Richard	NH	Harvard University	Economics	Harvard Univ
Col, Kathleen Jeananda	FL	University of Miami/FL	Developmental Psychology	U of Washington
Cole, James Vernon	SC	Clemson University	Chemical Engineering	U Cal Berkeley
Colodner, Debra Claire	NY	Yale University	Geochemistry	Mass Inst Tech
Comerford, Elizabeth Ann	NY	Manhattan College	History of Science	Johns Hopkins U
Conard, Cynthia Ann	NC	Univ of North Carolina	Experimental Psychology	U of No Carolina
Conroy, Jeffrey Michael	CA	Univ of Cal San Diego	Computer Science	Stanford Univ
Cook, Ruth Kimberley	NY	Colgate University	Biochemistry	Univ of Iowa
Cooper, Scott Thomas	MI	Michigan State Univ	Biochemistry	Univ of Wisconsin
Cotter, William Donald	MO	Grinnell College/IA	Physical Chemistry	U Cal Berkeley
Coucouvanis, Electra C	IA	University of Michigan	Molecular Biology	Univ of Wisconsin
Covert, Sarah Frances	NJ	Dartmouth College	Microbiology	Univ of Wisconsin
Crowell, James Alan	CA	Swarthmore College	Experimental Psychology	U Cal Berkeley
Cutler, David Matthew	CA	Harvard University	Economics	Mass Inst Tech
d'Alessandris, Paul D	PA	Carnegie-Mellon Univ	Theoretical Physics	Harvard Univ
Dalrymple, Stacie Ann	CA	Occidental College	Biochemistry	Johns Hopkins U
Daly, Elizabeth Marie	RI	Univ of Rhode Island	Electrical Engineering	Mass Inst Tech
Dassonville, Paul R	TX	Texas A&M University	Neuroscience	UCLA
DeBortoli, Mark Joseph	PA	Univ of Virginia	Electrical Engineering	Univ of Wisconsin
DeBusk, George Henry, Jr	SC	Clemson University	Ecology	U of No Carolina
Deck, Paul Anselm	MI	Hope College/MI	Physical Chemistry	U of Minnesota
DeCroix, Gregory Alan	OH	Miami University/OH	Mathematics/Applications	Rutgers Univ
de Dood, Paul C	LA	Georgia Inst Tech	Electrical Engineering	Mass Inst Tech
deGroot, Jenny	PA	Stanford University	Linguistics	Univ of Chicago
DeLaat, Andrea Marie	OH	Univ of Cincinnati	Organic Chemistry	Ohio State Univ
Del Favero, Brendan A	CT	Rensselaer Polytechnic	Industrial Engineering	Stanford Univ
Della Santina, Charles C	CA	Univ of Cal Davis	Bioengineering	U Cal Berkeley
Dement, Elise	CA	Pomona College/CA	Botany	U Cal Berkeley
DeMent-Liebenow, Pamela	OR	University of Oregon	Physiology	Northern Ill Univ
Dessau, Daniel Stephen	FL	Rice University	Solid State Physics	Stanford Univ
DiCarlo, David Anthony	OH	Case Western Reserve/OH	Theoretical Physics	Princeton Univ
Dinwoodie, Ian Hepburn	MT	Montana State Univ	Mathematics/Statistics	Northwestern Univ
Doney, Scott Christopher	CA	U of Cal San Diego	Oceanography	Mass Inst Tech
Doyle, Mark David	NY	Cornell University	Theoretical Physics	Harvard Univ
Earl, Edward Arthur	SC	Furman University	Chemistry	Univ of Utah
Eddy, Sean Roberts	PA	Cal Inst Technology	Molecular Biology	Univ of Colorado
Eiteman, Mark Andrew	OH	Va Poly Institute	Chemical Engineering	Univ of Virginia
Ekart, Michael P	KS	Kansas State Univ	Chemical Engineering	Univ of Illinois
Elkind, Mitchell Spencer	NY	Harvard University	History of Science	U Cambridge/ENG
Ellermeier, T J	NE	Harvard University	History of Science	Harvard Univ
Ellis, Michael C	IA	University of Iowa	Biology	Mass Inst Tech
Epp, Gregory Thomas	OH	Harvard University	Ecology	Harvard Univ
Epstein, Adam Lawrence	CT	Harvard University	Mathematics/Analysis	Stanford Univ
Erlanson, Edith Celeste	VA	Mass Inst Technology	Aeronautical Engineering	U Sydney/AUSTRL
Eshelman, Lyn Marie	IN	Purdue University	Chemical Engineering	Purdue Univ
Estergreen, Steven L	MT	U of Calif Berkeley	Mechanical Engineering	U Cal Berkeley
Etzioni, Oren Willi	MD	Harvard University	Computer Science	Carnegie-Mellon U
Ewert, Michael Kent	TX	University of Texas	Mechanical Engineering	Univ of Texas
Falk, Adam Frederick	NC	Univ of North Carolina	Theoretical Physics	Princeton Univ
Farinas, Javier Anibal	NJ	Rensselaer Polytechnic	Bioengineering	Cornell Univ

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NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Feldman, Jacob	NY	Harvard University	Developmental Psychology	Mass Inst Tech
Feldman, Pamela Caren	CA	Cal Inst Technology	Electrical Engineering	Cal Inst Tech
Fernald, John Gregg	NJ	Harvard University	Economics	Stanford Univ
Ferrari, James Bennett	NY	Middlebury College/VT	Ecology	U of Minnesota
Fiez, Julie Ann	ID	Emory University/GA	Neuroscience	Cal Inst Tech
Filvaroff, Ellen Hope	TX	Stanford University	Genetics	Yale University
Fingerman, Karen Lee	NH	Harvard University	Developmental Psychology	Yale University
Fishbein, Kenneth W	AR	University of Illinois	Physical Chemistry	Mass Inst Tech
Fogel, Micah Elton	WA	Univ of Washington	Mathematics/Geometry	U Cal Berkeley
Forshee, Richard Allen	MO	SE Missouri St Univ	Political Science	Univ of Michigan
Fourkas, John T	CA	Cal Inst Technology	Physical Chemistry	Stanford Univ
Fowles, Heather J	IL	University of Chicago	History of Science	Univ of Chicago
Fram, Miranda Susan	VA	Yale University	Geology	Johns Hopkins U
Freeman-Benson, Bjorn N	WA	Univ of Washington	Computer Science	U of Washington
Friedenberg, Matthew C	NJ	Rensselaer Polytechnic	Chemical Engineering	U Cal Berkeley
Friedman, Daniel Joseph	MD	Harvard University	Science Engineering	Harvard Univ
Friedman, Erich Jay	IN	Rose-Hulman Tech/IN	Mathematics/Algebra	Cornell Univ
Fujishige, Amy	CA	Univ of Cal Berkeley	Biochemistry	U Cal San Fran
Gallus, William Andrew	PA	Penn State University	Meteorology	Univ of Oklahoma
Garceau, Michael Francis	WA	US Military Academy	Aeronautical Engineering	U of Washington
Garcia, Dana M	TX	Texas A&M University	Physiology	U Cal Berkeley
Garcia, Meredith Mason	CA	St Marys Dom Coll/LA	Pharmacology	Tulane University
Gaudin, Timothy James	GA	University of Georgia	Zoology	Univ of Chicago
Gehlen, John N	WA	Univ of Washington	Physical Chemistry	Cornell Univ
Gemmell, Peter Stewart	IL	Yale University	Computer Science	U Cal Berkeley
Gerber, David Julian	OH	Mass Inst Technology	Molecular Biology	Harvard Univ
Gerdes, David William	OH	Carleton College/MN	Theoretical Physics	U Cal Berkeley
Gertner, Bradley Jay	CA	U of Calif San Diego	Theoretical Physics	U Cal San Diego
Ghanbari, Reza A	IL	University of Illinois	Electrical Engineering	Univ of Illinois
Ghemawat, Sanjay	NY	Cornell University	Computer Science	U Cal Berkeley
Ghosh, Partho	NY	Yale University	Biochemistry	U Cal San Fran
Giddings, Barton William	UT	University of Utah	Molecular Biology	Cal Inst Tech
Gillett, John Robert	WI	Univ of Wisconsin	Mathematics/Algebra	Stanford Univ
Givan, Robert Lawrence	VA	Stanford University	Computer Science	Carnegie-Mellon U
Goddard, Thomas D	CA	U of Calif Berkeley	Mathematics/Applications	U Cal Berkeley
Goldberg, Aaron Jay	CT	Harvard University	Computer Science	Stanford Univ
Goodman, Albert James	CA	Grinnell College/IA	Mathematics/Geometry	Mass Inst Tech
Gordon, Gabrielle A	CA	Cal Inst Technology	Astronomy	U Cal Santa Cruz
Gould, Laurie J	NY	Yale University	Linguistics	Univ of Chicago
Goutte, Caroline E	PA	Cornell University	Molecular Biology	U Cal San Fran
Graben, Eric Knox	SC	Clemson University	International Relations	Univ of Virginia
Grand, Stephen Ross	VA	University of Virginia	Political Science	Yale University
Grant, Christopher P	MO	Brigham Young Univ	Mathematics/Analysis	Brigham Young U
Green, Dorothy Rachel	OH	University of Michigan	Biochemistry	Harvard Univ
Greene, Pamela Ann	IL	Beloit College/WI	Economics	Univ of Wisconsin
Grigsby, Rosalind Allen	CO	Pomona College/CA	Urban & Regional Planning	Cornell Univ
Grimes, Eric Burton	MN	University of Minnesota	Molecular Biology	Univ of Wisconsin
Groom, Martha Jane	NJ	Princeton University	Ecology	Univ of Florida
Grossman, Robert Bruce	NY	Princeton University	Organic Chemistry	Harvard Univ
Gruber, Jonathan Holmes	NJ	Mass Inst Technology	Economics	Harvard Univ
Gulley, Edward W	NC	Princeton University	Aeronautical Engineering	Stanford Univ
Gurski, Gregory Chester	NC	Georgia Inst Tech	Electrical Engineering	Mass Inst Tech
Gutman, Leslie Diane	CA	U Calif San Diego	Neuroscience	U Cal-LA Ctr Hlth
Hagedorn, Karen Denise	TX	University of Texas	Petroleum Engineering	Stanford Univ
Haibt, Carolyn M	NY	Princeton University	Computer Science	Mass Inst Tech
Halpern, Aaron Lars	MA	Stanford University	Linguistics	Stanford Univ
Hammel, Gregory James	PR	Mass Inst Technology	Mechanical Engineering	Mass Inst Tech
Hamrick, Maura Lynn	MS	Miss Univ for Women	Biology	Johns Hopkins U
Hannaford, Susannah	ME	Cal Inst Technology	Neuroscience	U of Washington
Harper, Bradley Dale	MN	Macalester College/MN	Sociology	U of Minnesota
Harris, Eva	NY	Harvard University	Biochemistry	U Cal Berkeley
Harris, Jeffrey Martin	UT	Brigham Young Univ	Theoretical Physics	Cal Inst Tech
Harris, Nomi Lenore	NJ	Princeton University	Computer Science	Stanford Univ

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GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY87

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Hart, Damon Lane	TX	Rice University	Computer Science	Univ of Texas
Haviland, Martha Balliet	NJ	Rutgers University	Genetics	J Hopkins Med Ins
Hawkins, Lauraine Kirste	VA	VA Polytechnic Univ	Ecology	Univ of Arizona
Hecht, Gabrielle	PA	Mass Inst Technology	History of Science	U of Pennsylvania
Heide, Kyle Philip	ND	Indiana University	Anthropology	Indiana Univ
Heinricher, Peter M	AK	So Ill U-Edwardsville	Anthropology	Univ of Illinois
Heisler, Laura Magdolna	CA	Stanford University	Molecular Biology	Univ of Wisconsin
Heit, Evan Keith	NY	Univ of Pennsylvania	Experimental Psychology	Stanford Univ
Henderson, Leslie Ann	NM	Rice University	Computer Science	Carnegie-Mellon U
Herron, Jon C	CA	Princeton University	Zoology	U Cal Berkeley
Hess, Helen Catherine	CA	U Calif Los Angeles	Zoology	U of Washington
Hinde, Robert James	RI	Rensselaer Polytechnic	Chemistry	Cornell Univ
Hirsh, Katherine W	MN	Pitzer College/CA	Experimental Psychology	Johns Hopkins U
Hixon, John Gregory	OH	Case Westrn Reserve/OH	Social Psychology	Case Westrn Rsrve
Hlavaty, Debra Ann	MD	University of Virginia	Ecology	Univ of Virginia
Ho, David Chi-Ching	AZ	Harvey Mudd Coll/CA	Mathematics/Applications	New York Univ
Hoff, Ann Maria	IN	Columbia University	Phytopathology	Yale University
Hogquist, Kristin Ann	MN	St Catherine Coll/MN	Cellular Biology	Washington Univ
Holm, Elizabeth Ann	MI	University of Michigan	Materials Engineering	Cornell Univ
Holsinger, Anna E	VA	Duke University	Electrical Engineering	Stanford Univ
Horos, David Raymond	LA	Louisiana St University	Civil Engineering	Univ of Texas
Horowitz, Daniel Mark	CA	Harvard University	Molecular Biology	Harvard Univ
Horowitz, Marcie Ruth	NJ	Rutgers University	Geology	Bryn Mawr Coll
Hosken, Nancy Ann	CA	Cal Pol San Luis Obispo	Microbiology	U Cal San Diego
Hovis, Robert Corby	NC	Wake Forest University	History of Science	Harvard Univ
Howard, Brian T	OH	Northwestern Univ	Computer Science	Stanford Univ
Hudson, Duncan G	TX	University of Texas	Computer Science	Univ of Texas
Hummel, John Edward	VA	Mary Washington Coll/VA	Experimental Psychology	U of Minnesota
Huntsinger, Reid Charles	IL	University of Illinois	Mathematics/Algebra	Harvard Univ
Huppert, Gilbert Lee	NJ	University of Delaware	Chemical Engineering	Mass Inst Tech
Ishii-Eiteman, Marcia J	CA	Yale University	Sociology	Cornell Univ
Iverson, Andrew James	UT	University of Utah	Mathematics/Statistics	New York Univ
Jander, Georg	KS	Washington Univ/MO	Molecular Biology	Cal Inst Tech
Jansen, Kenneth Edward	MO	University of Missouri	Mechanical Engineering	Stanford Univ
Jeffrey, Lisa Claire	NJ	Princeton University	Theoretical Physics	Harvard Univ
Joe, Truman	TX	Rice University	Electrical Engineering	Stanford Univ
Joerg, Christopher Frank	NY	Mass Inst Technology	Electronic Engineering	Mass Inst Tech
Johnston, Jennifer Jill	PA	University of Delaware	Genetics	Johns Hopkins U
Jones, Douglas McLachlan	MN	Princeton University	Anthropology	Univ of Michigan
Josell, Daniel	FL	Harvard University	Materials Engineering	Stanford Univ
Jungreis, Douglas S	NY	Harvard University	Mathematics/Algebra	Univ of Chicago
Kane, Timothy Joseph	IL	University of Illinois	Electrical Engineering	Univ of Illinois
Kean, Leslie Susan	OH	Case Western Reserve/OH	Molecular Biology	Harvard Univ
Keating, Edward Geoffrey	IL	Northwestern University	Economics	Stanford Univ
Keenan, Philip Thomas	NH	Mass Inst Technology	Mathematics/Topology	Univ of Chicago
Kelley, Brian David	WI	University of Wisconsin	Bioengineering	Mass Inst Tech
Kerns, Douglas Alexander	IL	Northwestern University	Electronic Engineering	Mass Inst Tech
Kessler, Richard Eugene	IA	University of Iowa	Electrical Engineering	Univ of Iowa
Kilgore, William B	TX	Stanford University	Particle Physics	Cornell Univ
Klassen, R Bryan Scott	CA	U of Calif Berkeley	Inoranic Chemistry	Mass Inst Tech
Klein, Robert David	CA	U of Calif Berkeley	Biochemistry	Mass Inst Tech
Kleiner, Bruce Alan	WA	U of Calif Berkeley	Mathematics/Geometry	U Cal Berkeley
Koester, Susan E	TX	Columbia University/NY	Neuroscience	Washington U/MO
Kolar, Randall Lee	ID	University of Idaho	Civil Engineering	Mass Inst Tech
Komachi, Kelly	CA	U of Calif Berkeley	Biochemistry	U Cal San Fran
Koob, Michael Duane	ND	North Dakota St Univ	Molecular Biology	Univ of Wisconsin
Koonce, Timothy Brian	NC	No Carolina State U	Mathematics/Algebra	U Cal Berkeley
Krammin, Amy Katherine	MI	Michigan State Univ	Computer Science	Stanford Univ
Krasna, Richard S	NY	Yeshiva University/NY	Mechanical Engineering	Columbia Univ
Kreiter, Kathryn E	WI	Marquette University	Bioengineering	Northwestern Univ
Kuchnir, Louis Daniel	IL	Mass Inst Technology	Physical Chemistry	Stanford Univ
Kuo, Arthur Daniel	MI	University of Illinois	Mechanical Engineering	U Cal Berkeley
Kuperberg, Gregory John	AL	Harvard University	Mathematics/Geometry	Princeton Univ

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NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Kwong, Peter Dak-Pin	IL	University of Chicago	Biophysics	Univ of Chicago
Lachter, Joel Benjamin	CA	Harvard University	Developmental Psychology	Univ of Rochester
Lado, Karen Maria	NC	Cornell University	Genetics	Duke University
Lai, Quintin John	AL	University of Alabama	Chemical Engineering	Univ of Wisconsin
Lammert, Paul Edward	KS	Kansas State University	Theoretical Physics	Univ of Chicago
Larrick, Richard Paul	VA	William & Mary College	Social Psychology	Univ of Michigan
Larson, Guy Christian	UT	Brigham Young Univ	Mathematics/Applications	U Uppsala/Sweden
Lau, Estelle Tsui	MA	Wellesley College	Sociology	Harvard Univ
Laurenson, Patricia M	IL	Carleton College/MN	Genetics	U Cal Berkeley
Lawall, Julia Laetitia	VA	Oberlin College/OH	Computer Science	Carnegie-Mellon U
Lee, Maurice Yao-Tze	CA	Wheaton College/IL	Neuroscience	Cal Inst Tech
Lee, Nancy Y	WA	Univ of Washington	Electrical Engineering	Mass Inst Tech
Lee, Patricia Lani	HI	San Francisco St Univ	Physical Chemistry	Cal Inst Tech
Lee, Sonny Chung-Fang	OH	Cal Inst Technology	Inorganic Chemistry	Harvard Univ
Leger, Christopher Brian	LA	Louisiana State Univ	Mechanical Engineering	Louisiana St U
Levin, Nikki Anne	MA	Harvard University	Biology	U Cal Berkeley
Levine, Eric Stephen	MA	Mass Inst Technology	Experimental Psychology	Princeton Univ
Lewis, Melanie	ME	Cornell University	Computer Science	U of Washington
Li, Kathryn Dairoh	NJ	Princeton University	Electrical Engineering	Mass Inst Tech
Lieberman, Daniel Eric	RI	Harvard University	Anthropology	Univ of Michigan
Light, James Paul, II	OH	Miami University/OH	Organic Chemistry	Columbia Univ
Lim, Kian-Tat	PA	Haverford College/PA	Physical Chemistry	Cal Inst Tech
Lim, Veronica K	CA	U of Calif Berkeley	Bioengineering	U of Pennsylvania
Lin, Margaret C	IN	Purdue University	Industrial Engineering	U Cal Berkeley
Linse, Angela Rae	WA	Univ of Washington	Archeology	U of Washington
Linsey, Terry June	NY	Cornell University	Electrical Engineering	Stanford Univ
Linzer, Elliot Neil	MD	University of Maryland	Electrical Engineering	Columbia Univ
Listerud, Mark Donald	MT	Reed College/OR	Neuroscience	Harvard Univ
Lodi, Patricia Jean	PA	Mass Inst Technology	Biochemistry	Harvard Univ
Loeser, Jennifer G	MA	Harvard University	Physical Chemistry	Univ of Chicago
Long, David Esley	NC	Cal Inst Technology	Computer Science	Stanford Univ
Lord, Susan Marie	PA	Cornell University	Electrical Engineering	Stanford Univ
Ludwig, Gregory Scott	IN	Oberlin College/OH	Theoretical Physics	Stanford Univ
Luth, Sharon Jean	NM	Arizona State Univ	Materials Engineering	Mass Inst Tech
Machesky, Laura Marie	MI	Alma College/MI	Biophysics	Univ of Michigan
Madden, Dean Ross	MA	Harvard University	Biophysics	Harvard Univ
Mansen, Laurene Janet	IL	University of Illinois	Electrical Engineering	Stanford Univ
Manske, Loni Marit	MN	University of Minnesota	Chemical Engineering	U Cal Berkeley
Marshall, Todd L	OH	Bowling Green St U/OH	Ecology	Univ of Michigan
Martin, Benjamin Oliver	NY	Princeton University	Developmental Psychology	Stanford Univ
Masson, Paul James	MI	University of Michigan	Theoretical Physics	Princeton Univ
Mastandrea, Mark Steven	CT	Mass Inst Technology	Biochemistry	U Cal Berkeley
Mauro, R Anthony	CA	U of Calif San Diego	Social Psychology	Carnegie-Mellon U
McArthur, Monica Ann	CA	U of Calif Los Angeles	Mathematics/Applications	U Cal Berkeley
McBeth, Douglas Warren	CA	U of Calif Berkeley	Mathematics/Ops Research	Cornell Univ
McCleskey, Thomas Mark	CA	Harvey Mudd College/CA	Inorganic Chemistry	Stanford Univ
McCluney, Steven A	SC	Univ of South Carolina	Chemical Engineering	U of So Carolina
McCorriston, Joy	NJ	Univ of London/England	Anthropology	Yale University
McElhinny, Bonnie Sue	PA	Univ of Pittsburgh	Linguistics	Stanford Univ
McHenry, Michele Jane	IN	Purdue University	Civil Engineering	Purdue Univ
Meixner, Donald Laurence	CA	Cal Inst Technology	Physical Chemistry	Mass Inst Tech
Melsa, Peter James	IN	Univ of Notre Dame	Electrical Engineering	No Carolina St U
Meyer, Eric Stefan	IL	Harvard University	Physics	Harvard Univ
Miller, Geoffrey F	OH	Columbia University	Developmental Psychology	Stanford Univ
Miller, Heather M	CA	Rice University	Archeology	U of Pennsylvania
Miller, Michael Dean	KS	University of Kansas	Microbiology	Harvard Med Sch
Ming, Michael Eudene	PA	Harvard University	Genetics	Mass Inst Tech
Mitchell, John F	IN	Cornell University	Inorganic Chemistry	Univ of Chicago
Miyazaki, Wesley Y	IL	University of Illinois	Biochemistry	Harvard Univ
Modugno, Francesmary	NY	Cornell University	Computer Science	Carnegie-Mellon U
Mohney, Suzanne E	MO	Washington Univ/MO	Materials Engineering	U of Minnesota
Moormann, Amy Fay	NC	North Carolina State U	Computer Science	Mass Inst Tech
Morando, Alexander R	CA	U of Calif Berkeley	Mechanical Engineering	U Cal Berkeley

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NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Morefield, James David	AL	Northern Arizona Univ	Botany	Claremont Grad/CA
Morrison, Mary Elizabeth	NY	Princeton University	Microbiology	Columbia Univ
Mosher, Daniel Abbott	ME	Princeton University	Mechanical Engineering	Mass Inst Tech
Moxness, Michael Stuart	MN	Wartburg College/IA	Biochemistry	Princeton Univ
Mueller, Eugene G	IL	University of Illinois	Biochemistry	Harvard Univ
Muendel, Martin Heinrich	DE	Princeton University	Optical Physics	Mass Inst Tech
Mullin, Wallace Patrick	NE	Boston College	Economics	Univ of Chicago
Munson, Eric Jon	SD	Augustana College/SD	Analytic Chemistry	Texas A&M Univ
Muntean, John L	IN	Purdue University	Geochemistry	Univ of Michigan
Murphy, Steven Michael	MI	Michigan State Univ	Physiology	Univ of Michigan
Myers, Catherine E	NJ	University of Delaware	Computer Science	Carnegie-Mellon U
Nekola, Jeffrey C	IA	Coe College/IA	Botany	U of Washington
Nevison, Cynthia Dale	CA	U of Calif Berkeley	Environmental Engineering	Stanford Univ
Newcomb, Charlotte	CA	U of Calif San Diego	Inorganic Chemistry	U Cal Berkeley
Nguyen, Khanh Bao	CA	Cal Inst Technology	Electrical Engineering	Stanford Univ
Niewood, Eliahu H	NY	Mass Inst Technology	Aeronautical Engineering	Stanford Univ
Noble, Tracy Elizabeth	IL	University of Chicago	Theoretical Physics	U Cal Berkeley
Norton, Steven James	IN	Yale University	Political Science	Univ of Michigan
Nyhus, Karin Jean	MN	Grinnell College/IA	Molecular Biology	Cornell Univ
Nystrom, Leigh Erik	WI	University of Wisconsin	Experimental Psychology	Stanford Univ
Oehler, Karen Louise	TX	Rice University	Electrical Engineering	Stanford Univ
Oettinger, Gerald Samuel	CA	Univ of Calif Davis	Economics	Mass Inst Tech
Ogai, Amy E	HI	Univ of Washington	Physical Chemistry	Univ of So Calif
Olds, John Robert, II	SC	North Carolina State U	Aeronautical Engineering	Stanford Univ
O'Neill, Patrick Flynn	AZ	University of Arizona	Mathematics/Algebra	Stanford Univ
O'Neill, Thomas G	OR	Univ of Calif Berkeley	Physics/Space	Cal Inst Tech
Orchinik, Miles Robert	PA	San Francisco State U	Physiology	Oregon State Univ
Owen, Elizabeth Fitzhugh	PA	University of Michigan	Linguistics	Mass Inst Tech
Owen, William Mann, Jr	MD	Cal Inst Technology	Astronomy	Univ of Florida
Paik, Leo Seung Kon	IL	Stanford University	Molecular Biology	U Cal San Diego
Pan, Janet L	NY	Mass Inst Technology	Electrical Engineering	Mass Inst Tech
Pang, Alex Soojung-Kim	VA	Univ of Pennsylvania	History of Science	U of Pennsylvania
Perkowski, Patricia Lynn	NM	Rice University	Computer Science	Univ of Maryland
Perry, Susan Emily	IL	Washington Univ/MO	Anthropology	Univ of Michigan
Petersen, Daniel James	TX	University of Dallas	Molecular Biology	Rice University
Peterson, Merrill Alan	WA	Univ of Washington	Ecology	Princeton Univ
Petti, Thomas Foote	MD	University of Maryland	Chemical Engineering	Mass Inst Tech
Petzold, Ruth Marie	MD	Cornell University	Genetics	Univ of Wisconsin
Peurrung, Anthony Joseph	FL	Rice University	Electrowave Physics	Stanford Univ
Piatko, Christine	NY	New York University	Computer Science	Cornell Univ
Pierce, Daniel W	CO	Colorado College	Biochemistry	U Cal Berkeley
Pizarro, Pedro Jose	FL	Harvard University	Physical Chemistry	U Cal Berkeley
Polka, Lesley Anne	MD	Arizona State Univ	Electrical Engineering	Arizona State U
Pollock, Martha Jill	CA	Stanford University	Anthropology	Johns Hopkins U
Popenoe, Rebecca Craig	NJ	Bryn Mawr College/PA	Anthropology	Univ of Chicago
Porter, Timothy Allen	NC	Princeton University	Organic Chemistry	Mass Inst Tech
Portner, Paul Howard	TN	Princeton University	Linguistics	Mass Inst Tech
Postner, Marya Anne	NY	Georgetown Univ/DC	Genetics	Mass Inst Tech
Potyondy, David Oskar	MN	University of Minnesota	Civil Engineering	Cornell Univ
Povinelli, Daniel John	LA	Univ of Mass Amherst	Anthropology	Yale University
Premont, Richard Thomas	TX	Cal Inst Technology	Pharmacology	Mt Sinai Med/NY
Princ, Jo Ann	KS	University of Kansas	Microbiology	Univ of Wisconsin
Proctor, James David	OR	University of Oregon	Physical Geography	U Cal Berkeley
Puckett, Wanda Rae	GA	Georgia Inst Technology	Chemical Engineering	Univ of Wisconsin
Ranger-Moore, James R	MI	Manhattan College	Sociology	Cornell Univ
Redding, Kevin Edward	TX	Rice University	Biochemistry	U Cal Berkeley
Reichel, Francene Donna	NY	SUNY At Binghamton	Experimental Psychology	Brandeis Univ
Rejto, Paul Abraham	MN	Harvard University	Physical Chemistry	Stanford Univ
Renelt, David Andrew	SD	St Thomas College/MN	Economics	Harvard Univ
Reuber, Teresa Lynne	MO	Drury College/MO	Molecular Biology	Mass Inst Tech
Rice, Mary Jane	MI	Aquinas College/MI	Physiology	Michigan State U
Rice, Phoebe Ann	NY	Brandeis University	Biophysics	Yale University
Richards, Diana Eva-Ann	NH	Univ of Washington	Political Science	Yale University

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NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Richardson, Kenneth S	SC	Rice University	Mathematics/Geometry	Rice University
Ridgway, Stuart A	CA	Univ of Calif Berkeley	Theoretical Physics	Cal Inst Tech
Riecke, Jon Gary	NE	Williams College/MA	Computer Science	Mass Inst Tech
Riley, Ralph Hayward	HI	Univ of Washington	Ecology	Cornell Univ
Roberts, Bryan Wilson	PA	Univ of Pennsylvania	Economics	Harvard Univ
Roberts, John Milton, Jr	PA	Cornell University	Sociology	Cornell Univ
Rodrigues, George W	CA	Univ of Calif Berkeley	Chemical Engineering	Univ of Wisconsin
Rompel, John Taylor	CA	Univ of Calif Berkeley	Computer Science	Mass Inst Tech
Rosel, Patricia E	MN	Macalester College/MN	Biology	U Cal Santa Cruz
Rosen, Michael K	MI	University of Michigan	Organic Chemistry	U Cal Berkeley
Rosenthal, Janet Kay	PA	Cornell University	Molecular Biology	Mass Inst Tech
Roth, Joshua	CA	Univ of Calif Berkeley	Astronomy	Univ of Arizona
Rudd, Robert Eugene	VA	University of Virginia	Theoretical Physics	Princeton Univ
Rudelson, Justin Jon	CA	Dartmouth College	Anthropology	Harvard Univ
Ruetsche, Laura	IL	Carleton College/MN	History of Science	U of Pittsburgh
Russ, Stephen George	ME	Rensselaer Polytechnic	Mechanical Engineering	Stanford Univ
Russo, Frank D	CA	Stanford University	Molecular Biology	Princeton Univ
Rymarcsuk, Jim Arthur	MO	Stanford University	Aeronautical Engineering	Stanford Univ
Saints, Keith William	AZ	Harvey Mudd College/CA	Mathematics/Applications	New York Univ
Salser, Stephen James	CA	Cal Inst Technology	Molecular Biology	Harvard Univ
Salvino, Dominic Joseph	IL	University of Chicago	Solid State Physics	Stanford Univ
Salzinger, Leslie Lane	NY	Harvard University	Sociology	Harvard Univ
Sawin, Kenneth Eric	MA	Yale University	Cellular Biology	U Cal Berkeley
Schafer, William Ronald	GA	Harvard University	Biochemistry	U Cal Berkeley
Scheirer, Daniel Snyder	PA	Princeton University	Geophysics	Stanford Univ
Schwartz, Richard Evan	CA	Univ of Cal Los Angeles	Mathematics/Analysis	Stanford Univ
Schwerer, Elizabeth C	PA	Harvard University	Mathematics/Applications	New York Univ
Sculley, Terry Lee	FL	Georgia Inst Technology	Electrical Engineering	Georgia Inst Tech
Seligman, Lenny M	CA	Univ of Calif San Diego	Genetics	U of Washington
Sercel, Peter Charles	AZ	University of Arizona	Atomic Physics	Stanford Univ
Severtson, Roald Bradley	WA	Univ of Puget Sound	History of Science	Univ of Chicago
Shane, Stacey Francine	CA	Univ of Calif Berkeley	Physical Chemistry	Mass Inst Tech
Shaw, Stanley Yang	NY	Harvard University	Bioengineering	Mass Inst Tech
Sherman, Joyce Marie	PA	Lehigh University	Molecular Biology	Yale University
Sherry, Robert Franklin	MA	Yale University	Mathematics/Analysis	Princeton Univ
Shimeta, Jeffrey Scott	WI	Carleton College/MN	Bio-oceanography	U of Washington
Shirley, Eric L	CA	Cornell University	Solid State Physics	Univ of Illinois
Short, Timothy Wesley	WI	Swarthmore College/PA	Botany	Stanford Univ
Siebel, Christian W	CA	Pomona College/CA	Molecular Biology	Mass Inst Tech
Silver, James Howard	WY	University of Wyoming	Chemical Engineering	Univ of Wisconsin
Simkovich, Boris August	PA	Penn State University	Economics	Stanford Univ
Simmons, Alison Joyce	CT	Bucknell University	Experimental Psychology	U of Pennsylvania
Sipes, Christopher Neil	MA	Harvard University	Physical Chemistry	Cal Inst Tech
Smith, Elbert Claude	MS	University of Michigan	Aeronautical Engineering	Univ of Texas
Smith, Henrietta Mercer	MD	University of Colorado	Geophysics	Univ of Colorado
Smith, Sean William	PA	Princeton University	Computer Science	U Edinburgh/Scot
Smyrl, Eliot Kemp	NM	Univ of Calif Berkeley	Computer Science	Brown University
Sondergaard, Rolf	CA	Cal Inst Technology	Aeronautical Engineering	Stanford Univ
Spears, Larry Gene	TX	Rice University	Organic Chemistry	Cal Inst Tech
Srygley, Robert Baxter	PA	Univ of Washington	Ecology	Univ of Texas
Stabb, Mark C	WI	University of Wisconsin	Aeronautical Engineering	Cal Inst Tech
Stadler, Maurice Phillip	TX	Texas A&M University	Petroleum Engineering	Texas A&M Univ
Stark, Louisa Anne	IA	Grand Valley St Coll/MI	Botany	Univ of Colorado
Starovasnik, Melissa Ann	WA	Univ of Washington	Biochemistry	U of Washington
Steinberger, Elizabeth A	GA	Northwestern University	Anthropology	Stanford Univ
Steinke, John Martin	TX	Rice University	Mathematics/Analysis	Princeton Univ
Steinsaltz, David R	NY	Yale University	Mathematics/Algebra	Princeton Univ
Stell, Laurel Liane	TX	N Mex Inst Mining&Tech	Mathematics/Applications	Cornell Univ
Stewart, Barry Robert	WI	U of Wisc River Falls	Agricultural Science	Va Poly Inst
Stoltzfus, Rebecca Joyce	VA	Goshen College/IN	Nutritional Science	Cornell Univ
Stone, Julie Anne	NY	Union University/NY	Bioengineering	U of Pennsylvania
Stoyan, Nina Catherine	PA	Brown University	Ecology	U of Pennsylvania
Strite, Samuel Clagett	MD	Bucknell University	Solid State Physics	Univ of Illinois

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NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Suits, Arthur Gilmore	MO	University of Missouri	Physical Chemistry	U Cal Berkeley
Svee, Eric Rodger	CO	Colorado State Univ	Cellular Biology	U Cal Davis
Tai, An-Jen	MD	Mass Inst Technology	Economics	Mass Inst Tech
Takemoto, Darin Katsumi	CA	Cal Inst Technology	Biochemistry	Harvard Univ
Talbot, William S	FL	University of Florida	Molecular Biology	Stanford Univ
Tamura, Leilani Ruth	VA	Tulane University	Electrical Engineering	Stanford Univ
Tanaka, Traci Mariye	CA	U of Calif Los Angeles	Pharmacology	Johns Hopkins U
Tancredi, Christopher D	MN	Princeton University	Linguistics	Mass Inst Tech
Taub, Alison B	CA	U of Calif Los Angeles	Linguistics	U Mass Amherst
Taylor, Brian Dean	IA	University of Iowa	International Relations	Yale University
Thomas, Sarah Rebecca	WV	Mass Inst Technology	Computer Science	Stanford Univ
Thomas, Sean Conway	OR	Swarthmore College/PA	Ecology	Harvard Univ
Thorne, Jeffrey Loren	WI	University of Wisconsin	Genetics	U of Washington
Thorp, Herbert Holden	NC	Univ of North Carolina	Inorganic Chemistry	Cal Inst Tech
Thorsett, Stephen Erik	OR	Carleton College/MN	Theoretical Physics	Princeton Univ
Todd, Richard Michael	OK	University of Oklahoma	Electrical Engineering	Univ of Oklahoma
Tombaugh, Geoffrey C	MO	Haverford College/PA	Physiology	Stanford Univ
Tretter, Daniel Robert	IN	Rose-Hulman Tech/IN	Mathematics/Applications	Brown University
Twietmeyer, Eric Paul	IL	Mass Inst Technology	Mathematics/Geometry	Univ of Chicago
Ungar, Anne Ruth	NY	Harvard University	Cellular Biology	Northwestern Univ
Ungar, Lowell Warren	CA	Stanford University	Physical Chemistry	U Cal Berkeley
Unruh, Vance	KS	Kansas State Univ	Mechanical Engineering	Purdue University
Upper, Kim E	WI	University of Wisconsin	Genetics	U of Washington
Vane, Leland Morris	NY	University of Delaware	Chemical Engineering	Cornell Univ
Virgil, Scott C	CA	Cal Inst Technology	Organic Chemistry	Mass Inst Tech
Vivian, Jessica Malof	TX	University of Texas	Urban & Regional Planning	Cornell Univ
Volino, Ralph John	MI	Michigan State Univ	Mechanical Engineering	U of Minnesota
Wade, Elizabeth	OH	Pomona College/CA	Developmental Psychology	U of Pennsylvania
Wagenseil, Ross	CT	Harvard University	Environmental Science	Clemson Univ
Wagner, Martha May	IL	University of Chicago	Psychology	Univ of Chicago
Walker, Janet Shakuntala	MD	Harvard University	Social Psychology	Univ of Chicago
Wang, Charlotte I-Ting	CA	U of Calif Berkeley	Biochemistry	Mass Inst Tech
Warkentin, David John	CA	Mass Inst Technology	Aeronautical Engineering	Mass Inst Tech
Washabaugh, Andrew P	MI	University of Michigan	Electrical Engineering	Stanford Univ
Weinbaum, Eve Susan	PA	Yale University	Social Science	Princeton Univ
Weiner, Carl Daniel	NY	Mass Inst Technology	Mechanical Engineering	U Cal Berkeley
Weiser, Marybeth	PA	Penn State University	Physiology	Johns Hopkins U
Wellensiek, Margaret R	WI	Wellesley College/MA	Geology	Univ of Michigan
Welsch, David M	IA	Iowa State University	Developmental Psychology	U Cal Irvine
Werner, John H	TN	Northwestern University	Geophysics	U of Rhode Island
Whitson, Janet Susan	MO	Concordia College/IL	Neuroscience	U Cal Irvine
Wilner, David James	RI	Princeton University	Astronomy	U Cal Berkeley
Wilson, Randall Howard	OR	Harvard University	Computer Science	Stanford Univ
Winey, Karen Irene	PA	Cornell University	Chemical Engineering	U Mass Amherst
Wizansky, Abigail Ruth	CA	Univ of Calif Berkeley	Inorganic Chemistry	Cornell Univ
Wloch, Mary Kopke	MI	Wayne State Univ/MI	Microbiology	U of No Carolina
Woehle, Diana Louisa	NJ	Wells College/NY	Biochemistry	U of Wisconsin
Woltemade, Christopher J	OH	Ohio Wesleyan Univ	Geography	U of Wisconsin
Wootton, David MacMullen	NY	Cornell University	Mechanical Engineering	Mass Inst Tech
Wright, Otis Clarence	NJ	U of Sydney Australia	Theoretical Physics	Harvard Univ
Wright, Peter John	MI	Michigan State Univ	Particle Physics	Stanford Univ
Wynn, M Karen	MA	McGill University/Can	Developmental Psychology	Mass Inst Tech
Wysocki, Paul Francis	IL	University of Illinois	Electrical Engineering	Mass Inst Tech
Yeh, Chungsheng James	AL	Princeton University	Theoretical Physics	U Cal Berkeley
Young, Bruce Eric	CT	Cornell University	Ecology	U of Washington
Zamore, Phillip David	NY	Harvard University	Molecular Biology	Harvard Univ
Zeitz, Paul Andrew	NY	Harvard University	Geology	U Cal Berkeley
Zeller, Scott Steven	WI	University of Wisconsin	Earth Science	Stanford Univ
Zieve, Rena Joy	VA	Harvard University	Solid State Physics	Stanford Univ
Zuckerman, David Isaac	NY	Harvard University	Computer Science	Stanford Univ
Zwiebel, Jeffrey H	AZ	Princeton University	Economics	Mass Inst Tech

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NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Abler, Michael L.	WI	Univ of Wisconsin	Genetics	NC State Univ
Achilles, Geoffrey C.	NY	Cornell University	Chemical Engineering	Carnegie Mellon
Adams, Karen R.	CO	Stanford University	International Relations	Harvard Univ
Adler, Jeffrey D.	OH	Princeton University	Mathematics/Algebra	Univ of Chicago
Alvarez, Ramon A.	FL	Duke University	Physical Chemistry	Columbia Univ
Anderson, Douglas K.	UT	Brigham Young Univ	Sociology	Univ of Wisconsin
Anderson, John G.	CA	Brigham Young Univ	Economics	Harvard Univ
Anderson, Karl G.	LA	Louisiana State Univ	Chemical Engineering	La State Univ
Anderson, Laura M.	OH	Cal Inst of Tech	Mathematics/Algebra	Mass Inst of Tech
Ando, Matthew A.	PA	Princeton University	Math/Geometry	Mass Inst of Tech
Angelos, Elisabeth C.	WI	Univ of Wisconsin	Theoretical Physics	Cal Inst of Tech
Anton, Susan C.	CT	U of Calif Berkeley	Anthropology	U Cal Berkeley
Archer, Deborah L.	NJ	Penn State Univ	Microbiology	U of No Carolina
Armstrong, Elizabeth A.	KS	Univ of Michigan	Sociology	U Cal Berkeley
Ashley, Miriam A.	NV	Northern Arizona U	Physiology	U Cal Irvine
Askew, Ann L.	GA	Brown University	Mathematics	Cornell Univ
Auerbach, Scott M.	NY	Georgetown University	Physical Chemistry	U Cal Berkeley
Avery, Christopher N.	PA	Harvard University	Mathematics/Ops Research	Stanford Univ
Babson, Eric K.	OR	Cal Inst of Tech	Mathematics/Topology	Mass Inst of Tech
Bacher, Kenneth L.	CA	U of Southern Calif	Electrical Engineering	Stanford Univ
Bacon, Rebecca A.	IN	Purdue University	Cellular Biology	Yale University
Baer, John M.	MD	Yale University	Developmental Psychology	Princeton Univ
Bahcall, Safi R.	NJ	Harvard University	Theoretical Physics	Princeton Univ
Bain, James A.	PA	Univ of Pennsylvania	Material Engineering	Cornell Univ
Bair, Wyeth D.	PA	Penn State University	Computer Science	Cal Inst of Tech
Baker, August J.	NH	Columbia University	Economics	Mass Inst of Tech
Baldauf, John E.	TN	VA Poly Inst & St Univ	Electrical Engineering	Univ of Illinois
Balke, Alexander A.	CA	Univ of Cal San Diego	Computer Science	U Cal Berkeley
Ball, Patrick D.	PA	Columbia University	Sociology	Harvard Univ
Barnett, Elizabeth M.	NY	Wesleyan University	Microbiology	U of No Carolina
Bay, Randy S.	WI	Rose-Hulman Tech Inst	Mechanical Engineering	Univ of Illinois
Belsley, Eric D.	MA	Yale University	Mathematics/Algebra	Harvard Univ
Benatan, Ethan Joel	PA	U of Cape Town-S.Africa	Biochemistry	U of Pittsburgh
Bennett, Andrew E.	DC	Wesleyan University	Physical Chemistry	U Cal Berkeley
Bergengren, Jon C.	FL	San Francisco State	Ecology	U Cal Santa Barb
Berger, Karen H.	OH	Princeton University	Molecular Biology	Tufts Sch of Med
Berland, Carolyn R.	MN	Carleton College	Atomic Physics	Harvard Univ
Bertozzi, Carolyn R.	MA	Harvard University	Organic Chemistry	U Cal Berkeley
Bharucha, Kamal N.	NY	Brooklyn College	Organic Chemistry	U Cal Berkeley
Bhatnagar, Ranjit S.	CA	U of Calif Berkeley	Computer Science	U of Pennsylvania
Bickham, Scott R.	IN	Purdue University	Solid State Physics	Cornell Univ
Billings, Deborah L.	PA	Univ of Pittsburgh	Sociology	Univ of Michigan
Bird, Mark D.	VA	Michigan State Univ	Mechanical Engineering	Cornell Univ
Birkett, Bruce B.	CA	U of Calif - Berkeley	Biophysics	U Cal Berkeley
Blaylock, Richard L.	NY	Yale University	Physical Chemistry	Stanford Univ
Blount, Martha M.	CA	Southern OR State Col	Experimental Psychology	U Cal Davis
Bobbett, James E.	NY	SUNY at Buffalo	Mechanical Engineering	Stanford Univ
Bock, James J.	OH	Duke University	Atomic Physics	U Cal Berkeley
Borden, Douglas L.	CT	Dartmouth College	Theoretical Physics	Harvard Univ
Borthwick, David R.	KS	Princeton University	Theoretical Physics	U Cal Berkeley
Bortner, Donna M.	PA	Penn State Univ	Microbiology	Duke University
Boschelli, Louis J.	IL	Univ of Illinois	Chemical Engineering	Cal Inst of Tech
Bourquin, Leslie D.	OK	Oklahoma State Univ	Nutrition	Univ of Illinois
Bowen, David C.	CA	Brown University	Neuroscience	U Cal San Fran
Bowman, Christopher N.	IN	Purdue University	Chemical Engineering	Purdue University
Boyland, John B.	CA	U of Calif - Davis	Computer Science	U Cal Berkeley
Bradshaw, Lisa	MI	Univ of Michigan	Ecology	U Cal Davis
Braiterman, Jared I.	MD	Harvard University	Anthropology	U Cal Berkeley
Brand, Matthew E.	NY	Univ of Chicago	Computer Science	Mass Inst of Tech
Brandstein, Michael S.	VA	Brown University	Electrical Engineering	Mass Inst of Tech
Brecht, Barbara A.	IA	Iowa State University	Cellular Biology	Iowa State Univ
Brennan, Theodore D.	MI	Univ of Notre Dame	Inorganic Chemistry	Northwestern Univ
Brese, Nathaniel E.	MO	Northwestern Univ	Organic Chemistry	Arizona St Univ
Brockman, Rebecca A.	WI	U Wisc Stevens Point	Biochemistry	Univ of Wisconsin
Brooks, Dana Henry	PA	Temple University	Electrical Engineering	Northeastern Univ

APPENDIX A
GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Brown, Michael Edwards	AL	Princeton University	Astronomy	U Cal Berkeley
Browne, Elisabeth A.	MI	Washington University	Industrial Engineering	Stanford Univ
Bruhn, Laurakay	CA	U Calif Santa Barbara	Molecular Biology	U Cal San Diego
Buckser, Andrew S.	NH	Harvard University	Anthropology	U Cal Berkeley
Bulzacchelli, John F.	NY	Mass Inst of Tech	Electrical Engineering	Mass Inst of Tech
Burchard, Julja	OK	Stanford University	Cellular Biology	Stanford Univ
Burwell, Rebecca D.	MS	Southern Methodist U	Experimental Psychology	U of No Carolina
Bus, Ellen S.	CA	Cal Inst of Tech	Earth Science	Univ of Arizona
Butler, Karen D.	CA	Harvard University	Economics	London Sch Econ
Byers, Bruce E.	MO	Univ of Massachusetts	Zoology	Univ of Mass
Calaprice, Denise A.	NJ	Harvard University	Biology	Princeton Univ
Call, Charles T.	TX	Princeton University	Political Science	Stanford Univ
Campbell, Sabine P.	NY	Cornell University	Anthropology	Cornell Univ
Candell, Lawrence M.	NY	Mass Inst of Tech	Electrical Engineering	Mass Inst of Tech
Cardon, Zoe G.	UT	Utah State University	Botany	Stanford Univ
Carletta, Jean Carol	NY	Colgate University	Computer Science	Stanford Univ
Carletta, Joan E.	NY	SUNY at Buffalo	Electronic Engineering	Carnegie Mellon U
Carlisle, Robert G.	VA	Cambridge U of England	Aeronautical Engineering	Univ of Virginia
Carlson, Virginia A.	MO	Univ of Missouri	Inorganic Chemistry	Univ of Illinois
Carroll, Sean Michael	PA	Villanova University	Theoretical Physics	Princeton Univ
Chamberlin, Helen M.	UT	University of Utah	Neuroscience	Cal Inst of Tech
Chang, Belinda S.	NJ	Princeton University	Biology	Harvard Univ
Chang, Edward	NY	Brown University	Computer Science	Stanford Univ
Chen, Daniel T.	CO	Stanford University	Chemical Engineering	Univ of Wisconsin
Chen, Panda E.	CA	Mills College	Microbiology	Univ of Cal Davis
Chenevert, Janet M.	TX	Stanford University	Biochemistry	U Cal San Fran
Cheng, John	OR	Harvard University	History of Science	U Cal Berkeley
Chernew, Michael E.	PA	Univ of Pennsylvania	Economics	Harvard Univ
Cherry, Joshua L.	NY	Cornell University	Biology	Univ of Oxford
Ching, Lorilee S. L.	HI	U of Calif Berkeley	Bioengineering	U of Washington
Chomsky, Harry A.	MA	Harvard University	Mathematics/Logic	Mass Inst of Tech
Christensen, Raymond	NV	Brigham Young Univ	Political Science	Harvard Univ
Christeson, Gail L.	MD	Texas A&M University	Geophysics	Columbia Univ
Chu, David	CA	U of Calif Berkeley	Materials Engineering	U Cal Berkeley
Ciszek, Paul E.	CO	Colorado Sch of Mines	Solid State Physics	Cornell Univ
Clark, Ira E.	NY	Harvard University	Genetics	Mass Inst of Tech
Clark, Sheila S.	CA	U of Calif San Diego	Anthropology	U Cal Los Angeles
Clay, Karen B.	IL	University of Virginia	Economics	Mass Inst of Tech
Clune, Thomas L.	AL	Mass Inst of Tech	Theoretical Physics	Princeton Univ
Coakley, Clint W.	VA	VA Poly Inst & State U	Statistics	Penn State Univ
Cockayne, Eric J.	NY	SUNY at Buffalo	Theoretical Physics	Princeton Univ
Cocroft, Reginald B.	VA	Catholic University	Zoology	Univ of Texas
Cohen, Dawn M.	NY	Columbia-Barnard	Computer Science	Rutgers Univ
Cohen, Gal A.	WI	Stanford University	Physiology	Yale University
Colby, Jennifer L.	IA	Carleton College	Molecular Biology	U Cal Berkeley
Collins, Carl L.	TX	Texas A&M University	Optical Physics	Stanford Univ
Collins, Lisa A.	OH	Otterbein College	Analytical Chemistry	Ohio State Univ
Comalander, Donna R.	SC	Furman University	Environmental Engineering	U of No Carolina
Connor, Adam John	IL	University of Illinois	Anthropology	Penn State Univ
Cooper, Eric Edward	KS	University of Kansas	Experimental Psychology	Stanford Univ
Cordas, Steven G.	MO	University of Missouri	Industrial Engineering	Univ of Missouri
Cordes, Matthew H.	NJ	Bowdoin College	Organic Chemistry	Yale University
Corkill, Jennifer L.	OH	Rice University	Solid State Physics	Cornell Univ
Cortese, James M.	NE	University of Nebraska	Experimental Psychology	Univ of Illinois
Costes, Constantine N.	AL	Harvard University	Mathematical Analysis	U Cal Berkeley
Cox, Juliet E.	IN	Rice University	Genetics	U Cal Berkeley
Cox, Keith Alan	TX	Texas A&M University	Electrical Engineering	Mass Inst of Tech
Craig, Carole Anne	TX	University of Texas	Electronic Engineering	Stanford Univ
Craig, Gordon Samuel	AZ	Stanford University	Chemical Engineering	Mass Inst of Tech
Crespi, Vincent H.	MA	Mass Inst of Tech	Theoretical Physics	Stanford Univ
Crooks, Geoffrey B.	NE	University of Nebraska	Experimental Psychology	U of No Carolina
Culjak, Miriam S.	CA	U Calif Santa Barbara	Economics	Stanford Univ
Cullen, Michael J.	WI	Marquette University	Mathematics	U Cal Los Angeles

APPENDIX A
GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Culp, Patricia A.	CA	U of Calif San Diego	Molecular Biology	Mass Inst of Tech
Curley, Robert M.	WA	Univ of Puget Sound	Theoretical Physics	Princeton Univ
Cutrell, William D.	TX	Cal Inst of Technology	Molecular Biology	Mass Inst of Tech
Dauber, Susan L.	NJ	Johns Hopkins Univ	Sociology	Johns Hopkins U
Daugherty, Tamara L.	VA	Purdue University	Chemical Engineering	Carnegie Mellon U
Davidson, Douglas Ross	VA	Princeton University	Theoretical Physics	Harvard Univ
Davis, Brain Edward	MO	Emory University	Political Science	U Cal Berkeley
Davis, Geoffrey Mark	NC	Duke University	Mathematics	New York Univ
Davis, Patricia Lynne	OH	U Southern Mississippi	Molecular Biology	Ohio State Univ
de Boor, Peter C.	WI	Princeton University	Mathematical Analysis	Harvard Univ
deCharms, Richard C.	MO	Brown University	Organic Chemistry	Columbia Univ
Dellis, Stephanie	MI	Michigan State Univ	Microbiology	Univ of Wisconsin
Denenberg, Julie Orner	CA	U of Calif Santa Cruz	History of Science	U of Pennsylvania
Dernburg, Abby F.	CA	U of Calif Berkeley	Biochemistry	Cal Inst of Tech
Deutsch, James C.	RI	Harvard University	Anthropology	Univ of Cambridge
Dewey, Torin Miles	MI	University of Michigan	Inorganic Chemistry	U Cal Berkeley
Diamond, Scott E.	MA	Wesleyan University	Cellular Biology	Univ of Colorado
Dietsche, Laura J.	CA	U of Calif Berkeley	Chemical Engineering	U Cal Berkeley
Dismer, Berit G.	ID	Trinity University	Physical Chemistry	U Cal Berkeley
Dixon, Mark D.	IA	Iowa State University	Ecology	U Cal Berkeley
Doak, Patricia	AK	Dartmouth College	Ecology	U of Washington
Donahue, Eileen Marie	OH	Ohio State University	Psychology	U Cal Berkeley
Dooley, Samuel S.	TX	Texas A&M University	Computer Science	U Cal Berkeley
Duberstein, Laura J.	NJ	Princeton University	Social Science	U of Pennsylvania
Dudley, Erastus C.	MD	Yale University	Genetics	Yale University
Durek, Joseph J.	CA	U of Calif Berkeley	Geophysics	Harvard Univ
Dusenberry, Jeffrey A.	IA	Northwestern University	Environmental Engineering	Mass Inst of Tech
Edlin, Aaron S.	CA	Princeton University	Economics	Mass Inst of Tech
Efroymson, Rebecca A.	PA	La Salle University	Pharmacology	Cornell Univ
Eide, Ellen M.	KS	University of Kansas	Electrical Engineering	Mass Inst of Tech
Elby, Andrew R.	NJ	Harvard University	Physics	U Cal Berkeley
Eliezer, David	MI	University of Michigan	Theoretical Physics	Stanford Univ
Emberling, Geoffrey A.	CA	Harvard University	Archeology	Univ of Michigan
Espenson, Jane A.	IA	U of Calif Berkeley	Linguistics	U Cal Berkeley
Espeseth, Amy S.	MD	University of Virginia	Microbiology	U of No Carolina
Etheridge, Herbert T.	FL	Univ of West Florida	Physical Chemistry	Univ of Minnesota
Etter, Robert G.	TN	U of North Carolina	Anthropology	U Cal Berkeley
Eubank, Christopher E.	FL	Duke University	Geology	Duke University
Evans, Kristi S.	FL	Emory University	Anthropology	Univ of Chicago
Evenson, Jeffrey W.	WA	Mass Inst of Tech	Theoretical Physics	Harvard Univ
Everaert, Teri Lynn	WY	University of Wyoming	Electrical Engineering	Univ of Cal Davis
Everett, Matthew J.	MA	University of Michigan	Electrical Engineering	U Cal Los Angeles
Fabijanski, Lisa A.	MD	Loyola College	Molecular Biology	Mass Inst of Tech
Fanning, Elinor Wynne	WA	Oberlin College	Biology	Harvard Univ
Fath, Michael John	OH	Miami University	Microbiology	Harvard Med Sch
Fauman, Eric B.	MI	University of Michigan	Biochemistry	U Cal San Fran
Feeser, Hilarey R.	MI	Univ of Massachusetts	Neuroscience	Yale University
Feldman, Sandra F.	MI	University of Michigan	Electrical Engineering	Univ of Michigan
Feng, Jomnathan L.	CA	Harvard University	Theoretical Physics	U Cal Berkeley
Fiez, Timothy E.	ID	University of Idaho	Agronomy	Oregon State Univ
Finnerty, Casey M.	IL	University of Chicago	Entomology	Cornell Univ
Fisher, Daniel R.	NY	Princeton University	Neuroscience	Mass Inst of Tech
Fisher, Nancy A.	NJ	Princeton University	Physical Chemistry	Stanford Univ
Fisher, Sara E.	IN	Purdue University	Economics	Mass Inst of Tech
Fiske, Peter S.	MD	Princeton University	Geology	U Cal Los Angeles
Flatte, Michael E.	CA	Harvard University	Theoretical Physics	U Cal Berkeley
Fleeson, William W.	MN	University of Wisconsin	Psychology	Univ of Michigan
Fong, Andrew	AR	Rhodes College	Analytical Chemistry	U of No Carolina
Fontenot, Kevin J.	TX	Texas A&M University	Chemical Engineering	Georgia Tech
Ford, Benjamin J.	MN	New College - S Fla U	Mathematics/Algebra	Univ of Oregon
Fortun, Michael A.	PA	Hampshire College	History of Science	Harvard Univ
Fowler, John E.	GA	University of Georgia	Genetics	U Cal Berkeley
Fox, Douglas J.	FL	University of Houston	Engineering	Penn State Univ

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NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
France, Marcia B.	IL	Mass Inst of Tech	Organic Chemistry	Yale University
Freeman, Louise M.	TN	Emory University	Neuroscience	U Cal Berkeley
Fuchs, Daniel M.	IN	Princeton University	Political Science	Stanford Univ
Fuchs, Jacqueline L.	CA	U of Cal Los Angeles	Linguistics	U Southern Calif
Fullenkamp, Connel R.	SD	Michigan State Univ	Economics	Harvard Univ
Gaffen, Sarah L.	VA	Carnegie Mellon Univ	Molecular Biology	U Cal Berkeley
Gaidos, Eric J.	OR	Cal Inst of Tech	Aeronautical Engineering	Mass Inst of Tech
Gates, David A.	CA	Cal Inst of Tech	Electrical Engineering	U Cal Berkeley
Gaulding, Jill Renee	WA	Mass Inst of Tech	Computer Science	Mass Inst of Tech
Geddis, Donald F.	CA	Stanford University	Computer Science	Stanford Univ
George, Robert E.	OH	Wittenberg University	Mathematics/Statistics	Ohio State Univ
Gerald, James A.	MS	Univ of Mississippi	Electrical Engineering	Syracuse Univ
Gerber, Alan S.	OH	Yale University	Economics	Mass Inst of Tech
Geschwind, Carl-Henry	NC	Duke University	Geology	U Cal Santa Cruz
Gibson, Michael S.	CA	Stanford University	Economics	Harvard Univ
Gingerich, D. Pierre	VA	Swarthmore College	Ecology	Cornell Univ
Glass, Susan J.	NY	Duke University	Genetics	Mass Inst of Tech
Glassman, Timothy E.	NY	SUNY at Buffalo	Inorganic Chemistry	Mass Inst of Tech
Gleicher, Faith H.	NY	Yale University	Social Psychology	Ohio State Univ
Glickstein, Lisa J.	NY	Cornell University	Microbiology	Cornell Univ
Glim, Stephen M.	NY	Princeton University	Computer Science	Mass Inst of Tech
Gloss, Lisa M.	MI	Michigan State Univ	Biochemistry	Mass Inst of Tech
Glueck, Daniel S.	OH	Harvard University	Atomic Physics	U Cal Berkeley
Gluhoski, Vicki Lee	PA	Univ of Pennsylvania	Psychology	U of Pennsylvania
Gnanadesikan, Anand	NJ	Princeton University	Oceanography	Mass Inst of Tech
Gold, David Mark	CO	University of Colorado	Engineering	Mass Inst of Tech
Goldman, Charles A.	NJ	Mass Inst of Tech	Economics	Stanford Univ
Goldsmith, Morris B.	VA	U of Cal Los Angeles	Experimental Psychology	Carnegie-Mellon U
Golowich, Steven E.	MA	Cornell University	Theoretical Physics	Princeton Univ
Gooch, Carl F.	MO	Rice University	Aeronautical Engineering	Stanford Univ
Goodson, Holly V.	IN	Princeton University	Biochemistry	U Cal Berkeley
Gordon, Carl Lee	IN	Harvard University	Biophysics	Harvard Univ
Gordon, Dana M.	CA	U of Cal Los Angeles	Organic Chemistry	Yale University
Graves, Kenneth A.	TN	Mass Inst of Tech	Computer Science	U Cal Berkeley
Greenberg, Stacey A.	CT	Vassar College	Ecology	Princeton Univ
Greene, Spencer H.	TX	Rice University	Electrical Engineering	Stanford Univ
Greene, Steven B.	MD	Yale University	Experimental Psychology	Stanford Univ
Greenwood, Anders C.	CO	U of Calif Berkeley	Molecular Biology	Yale University
Grieneisen, Michael L.	PA	Shippensburg Univ	Biology	U Cal Berkeley
Grochocinski, James M.	IL	University of Illinois	Theoretical Physics	Princeton Univ
Groh, Jennifer M.	VT	Princeton University	Neuroscience	Johns Hopkins U
Grote, Eric A.	IL	Mass Inst of Tech	Biochemistry	U Cal San Fran
Gyugyi, Paul J.	PA	Penn State University	Electrical Engineering	Mass Inst of Tech
Haack, James A.	IA	University of Iowa	Mechanical Engineering	Univ of Iowa
Haak, Cristopher A.	MN	Purdue University	Chemical Engineering	Univ of Mass
Hack, Mace A.	CT	Princeton University	Zoology	Cornell Univ
Haidt, Jonathan D.	NY	Yale University	Social Psychology	U of Pennsylvania
Hall, David Wayne	NC	Rice University	Zoology	Duke University
Halliburton, Michael C.	TN	Memphis State Univ	History of Science	Univ of Wisconsin
Hamkins, Joel D.	MI	Cal Inst of Tech	Mathematics/Logic	U Cal Berkeley
Hammes, Sharon L.	NY	Princeton University	Physical Chemistry	U Cal Berkeley
Harris, Eva	NY	Harvard University	Biochemistry	U Cal Berkeley
Hartley, Dana E.	CA	U of Cal Los Angeles	Analytical Chemistry	U Cal Los Angeles
Haskell, Paul E.	NJ	U of Calif Berkeley	Electronic Engineering	U Cal Berkeley
Hauser, John R.	NC	North Carolina State	Computer Science	Univ of Colorado
Hayashibara, Kathleen	CA	Cal Inst of Tech	Organic Chemistry	Harvard Univ
Hayob, Jodie L.	KS	University of Wisconsin	Geology	Univ of Michigan
Heffernan, Paul J.	NC	Duke University	Mathematics/Ops Research	Cornell Univ
Heirich, Alan B.	MI	University of Michigan	Computer Science	U Cal San Diego
Helsel, Mark P.	MT	Univ of Pennsylvania	Mechanical Engineering	U of Pennsylvania
Henke, Christina M.	PA	Penn State University	Molecular Biology	Penn State Univ
Henthorn, Karla S.	IL	William & Mary Coll	Genetics	Univ of Michigan
Heppell, Kevin G.	OR	U of Calif Berkeley	Electrical Engineering	Mass Inst of Tech
Hergenrother, John M.	NJ	Princeton University	Solid State Physics	Harvard Univ
Herrick, Jeffrey E.	OH	Swarthmore College	Soil Science	Ohio State Univ

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GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Heuss-LaRosa, Kathleen	IN	Purdue University	Biochemistry	Purdue University
Hicke, Brian J.	CA	U of Cal Los Angeles	Cell Biology	Univ of Colorado
Hickman, Daniel A.	IL	Iowa State University	Chemical Engineering	Univ of Minnesota
Hinds, David A.	IL	University of Chicago	Biochemistry	Stanford Univ
Hines, Anne E.	CO	Boston University	Bioengineering	Case Western Rsv
Hirata, David M.	MD	Drew University	Ecology	Brown University
Ho, Francis	HI	Cal Inst of Tech	Optical Physics	Stanford Univ
Ho, Minnie	IL	Princeton University	Electrical Engineering	Stanford Univ
Ho, Nan	TN	Stanford University	Cellular Biology	U Cal San Fran
Hodgdon, Jennifer A.	WA	Univ of Washington	Solid State Physics	Harvard Univ
Holcomb, Tyler R.	TX	University of Texas	Chemical Engineering	Cal Inst of Tech
Hollingshead, James R.	CA	Stanford University	International Relations	U Cal Berkeley
Homiller, Stephen J.	GA	Georgia Inst of Tech	Mechanical Engineering	Georgia Tech
Horita, David A.	WA	Carleton College	Physical Chemistry	U Cal Berkeley
Horvath, Martin	MA	Brown University	Biochemistry	U of Washington
Horwat, Waldemar P.	IL	Mass Inst of Tech	Computer Science	Mass Inst of Tech
Howard, Beth A.	PA	Univ of Pittsburgh	Economics	Univ of Chicago
Hsieh, Wilson C.	NY	Mass Inst of Tech	Computer Science	Mass Inst of Tech
Huff, Richard A.	CA	U of Calif Santa Barb	Computer Science	Carnegie Mellon U
Huffman, Laree M.	KS	Texas A&M University	Microbiology	U Cal Berkeley
Huffman, Scott B.	PA	Carnegie Mellon Univ	Computer Science	Stanford Univ
Hull, Christopher D.	CA	U of Calif San Diego	Electronic Engineering	U Cal Berkeley
Humphries, John W.	TX	Texas A&M University	Civil Engineering	Univ of Colorado
Hung, Deborah T.	IL	Harvard University	Organic Chemistry	U Cal Berkeley
Hunt, Elizabeth E.	IN	Indiana University	History of Science	U of Pennsylvania
Hur, Sun H.	TX	University of Texas	Aeronautical Engineering	Stanford Univ
Hwang, Jack Y.	CA	U of Calif Berkeley	Chemical Engineering	Cal Inst of Tech
Ilag, Lawrence L.	OH	Univ of Philippines	Molecular Biology	Harvard Univ
Ireland, Peter N.	MA	University of Chicago	Economics	Univ of Chicago
Iwata, Lori K.	CA	Univ of Southern Calif	Physical Chemistry	Cornell Univ
Jacobs, Marc D.	TX	Rice University	Biochemistry	Mass Inst of Tech
Jacobs, Marc D.	NE	Stanford University	Genetics	Univ of Cambridge
Jacobson, Stuart A.	NY	Princeton University	Mechanical Engineering	Stanford Univ
Janc, James W.	MD	U Maryland Balt County	Biochemistry	Univ of Wisconsin
Jaramillo, Narcisco B.	CA	Univ of Notre Dame	Computer Science	Stanford Univ
Jefferson, George J.	PA	University of Delaware	Mechanical Engineering	Univ of Delaware
Jenkins, Jon M.	FL	Georgia Inst of Tech	Electrical Engineering	Georgia Tech
Jennings, James S.	NJ	Cornell University	Computer Science	Cornell Univ
Jockusch, William C.	IL	Carleton College	Mathematics/Algebra	Princeton Univ
Johnson, Erik A.	IL	University of Illinois	Aeronautical Engineering	Univ of Illinois
Johnson, Robert D.	NY	Cornell University	Chemical Engineering	Cal Inst of Tech
Jones, Charles E.	WI	Stanford University	Geochemistry	Harvard Univ
Jones, Jason A.	PA	Penn State University	Mathematics/Algebra	Yale University
Jones, Laura E.	CA	U of Calif Riverside	Geophysics	Mass Inst of Tech
Junk, Thomas R.	IL	Mass Inst of Tech	Particle Physics	Stanford Univ
Kaemingk, Kristine L.	CO	Metropolitan State Col	Experimental Psychology	Univ of Arizona
Kalb, Jeffrey C.	MA	Rensselaer Poly Inst	Materials Engineering	Rensselaer Poly
Kamien, Randall D.	IL	Cal Inst of Tech	Theoretical Physics	Harvard Univ
Kanaga, Brian W.	CO	Johns Hopkins Univ	Mathematics/Topology	Princeton Univ
Kantor, Ronald M.	NY	Princeton University	Theoretical Physics	Stanford Univ
Karagueuzian, Dikran B.	CA	Stanford University	Mathematics	Princeton Univ
Karlstrom, Rolf O.	AZ	Northern Arizona Univ	Molecular Biology	Univ of Utah
Karttunen, Jaana T.	TX	Harvard University	Cellular Biology	U Cal Berkeley
Keck, Canada K.	TX	Texas Tech University	Sociology	Ohio State Univ
Keeney, Scott N.	MD	Va Poly Inst & St U	Biochemistry	U Cal Berkeley
Kelly, Julia Ann	CA	U Calif Santa Barbara	Microbiology	U of Washington
Kessler, Daniel P.	MA	Harvard University	Economics	Mass Inst of Tech
Khuri-Makdisi, Kamal	NC	Yale University	Mathematics/Algebra	Harvard Univ
Kim, Hidong	MI	Oberlin College	Physical Chemistry	Harvard Univ
Kimoto, Paul A.	CA	Oberlin College	Theoretical Physics	Harvard Univ
King, Tracy H.	NY	Mass Inst of Tech	Linguistics	Mass Inst of Tech
King, Valarie E.	NJ	Rutgers University	Sociology	U of Pennsylvania
Kiorpes, Stephen T.	NY	University of Wisconsin	Geochemistry	U of Washington
Kirby, Carl Scott	NC	Univ of North Carolina	Geochemistry	Va Tech Univ
Klecan, Lindsey O.	FL	Duke University	Economics	Mass Inst of Tech

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NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Klimko, Peter G.	OH	Ohio State University	Organic Chemistry	Texas A&M Univ
Knowles, Lauren A.	CA	Univ of Southern Cal	Genetics	U Cal Berkeley
Knox, John A.	AL	U of Alabama Birmingham	Meteorology	Univ of Wisconsin
Kolm, Peggy J.	CA	U of Calif Berkeley	Biochemistry	Mass Inst of Tech
Kornegay, Janet Rene	OR	Lewis and Clark Coll	Cellular Biology	Stanford Univ
Koski, Gary Kevin	OH	Kent State University	Microbiology	Johns Hopkins Med
Kossler, Daniel P.	MO	Harvard University	Economics	Mass Inst of Tech
Krause, Karl R.	IL	University of Illinois	Chemical Engineering	Univ of Minnesota
Krieger, David B.	NE	Drake University	Geophysics	U Cal Los Angeles
Kudla, Arthur J.	MI	Kalamazoo College	Pharmacology	Harvard Univ
Kuehmann, Charles Jay	AZ	Arizona State Univ	Materials Engineering	Arizona State U
Kulick, Jonathan David	DC	Swarthmore College	Mechanical Engineering	Stanford Univ
Kuske, Rachel Ann	WI	U of Wisc Green Bay	Mathematics	Northwestern Univ
LaChapelle, Francis X.	OR	Willamette College	Social Science	Stanford Univ
Laibson, David I.	PA	Harvard University	Economics	Mass Inst of Tech
Langston, Nancy Ellen	MD	Dartmouth College	Zoology	U of Washington
Larudee, Mehrene Emma	MI	U of Calif Berkeley	Economics	Univ of Mass
LaSalle, Janine M.	VA	Randolph-Macon College	Microbiology	Harvard Med Sch
Lasko, Daniel R.	IL	Rice University	Bioengineering	Mass Inst of Tech
LeDeaux, John Robert	VA	University of Virginia	Genetics	Mass Inst of Tech
Lederer, Anne Labarr	NH	Columbia University	Developmental Psychology	U of Pennsylvania
Lee, Christopher J.	CA	Harvard University	Biophysics	U Cal San Fran
Lee, Karen Ko-Chia	IL	Mass Inst of Tech	Chemical Engineering	Univ of Minnesota
Lee, Kevin John	OH	University of Michigan	Molecular Biology	Mass Inst of Tech
Lee, Timothy Jerome	CA	U of Calif Berkeley	Computer Science	U Cal Berkeley
Leo, John Garrett	IN	Mass Inst of Tech	Computer Science	Mass Inst of Tech
Lepson, Jaan Kaimanu	HI	Princeton University	Zoology	Univ of Hawaii
Leroy, Stephen Sylvain	VA	Cornell University	Meteorology	U of Washington
Lewis, Richard L.	FL	Univ of Central Florida	Computer Science	Carnegie-Mellon U
Lewis, Steven Paul	IL	University of Illinois	Optical Physics	Stanford Univ
Liao, Lushalan Boy-Yu	CA	Cal Inst of Tech	Physics	Harvard Univ
Lieberman, Robert C.	MA	Yale University	Political Science	Harvard Univ
Lim, Nancy Lee	CA	Univ of Calif Berkeley	Mathematical Analysis	New York Univ
Lin, Ann Chih	NJ	Princeton University	Political Science	Univ of Chicago
Listgarten, Sheralyn	PA	Univ of Pennsylvania	Computer Science	Stanford Univ
Lofgren, Brent Melvin	MN	Augsburg College	Atmospheric Science	Princeton Univ
Longin, Teresa Lynn	WA	Ithaca College	Physical Chemistry	U Cal Berkeley
Looper, Matthew George	MO	Duke University	Genetics	Cornell Univ
Lopez-Matalobos, Manuel	FL	Harvard University	Political Science	Univ of Chicago
Lowe, John Andrew	TN	Rose-Hulman Tech Inst	Electrical Engineering	Mass Inst of Tech
Lowe, Lydia K.	GA	Amherst College	Neuroscience	Columbia Univ
Lumer, Gerald B.	NJ	Duke University	Economics	Mass Inst of Tech
Lusk, Mark T.	LA	US Naval Academy	Electrical Engineering	Colorado State U
Luty, Markus Amadeus	UT	University of Utah	Particle Physics	Univ of Chicago
Macfarlane, Allison M.	CT	University of Rochester	Geology	Mass Inst of Tech
MacFerrin, Kurtis D.	AZ	Occidental College	Organic Chemistry	Yale University
MacLeod, Cheryl Anne	IA	University of Iowa	Chemical Engineering	U Cal Berkeley
Mainwaring, Scott David	MA	Harvard University	Developmental Psychology	Stanford Univ
Makadok, Richard J.	NJ	Yale University	Economics	Mass Inst of Tech
Malarney, Shaun K.	MI	Boston University	Anthropology	Univ of Michigan
Marks, Cara Berman	WI	University of Wisconsin	Biochemistry	Stanford Univ
Markus, Michelle A.	NY	Rensselaer Poly Inst	Biophysics	Harvard Univ
Marolf, Donald M.	MO	William Jewell College	Particle Physics	Univ of Texas
Marr, David Wayne	MO	U of Calif Berkeley	Chemical Engineering	Mass Inst of Tech
Marsh, Richard L.	CT	Wesleyan University	Experimental Psychology	Stanford Univ
Marshall, Bruce R.	CA	U of Cal Santa Barbara	Physics	U Cal Santa Barb
Martau, James M.	OH	Bucknell University	Bioengineering	Case Western Rsv
Martens, Jon Scott	WI	University of Wisconsin	Electronic Engineering	Univ of Wisconsin
Marvin, Martha Jean	CA	U of Calif Berkeley	Molecular Biology	Mass Inst of Tech
Massengale, Alan Ross	NE	Duke University	Electrical Engineering	Univ of Illinois
Mathews, Gordon Clark	AK	Yale University	Anthropology	Cornell Univ
McCarthy, Anders W.	MN	Washington University	Electrical Engineering	Washington Univ
McCarty, John Paul	WI	University of Wisconsin	Zoology	Cornell Univ
McDuffie, Stephen M.	OR	Whitman College	Geology	Johns Hopkins U
McGonigle, Brian	PA	University of Delaware	Genetics	Yale University

APPENDIX A
GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
McGrath, Michael J.	CA	U of Calif Berkeley	Mathematics/Algebra	Harvard Univ
McIntosh, Daniel N.	UT	University of Denver	Social Psychology	Univ of Michigan
McIntyre, John P.	CA	U of Calif San Diego	Bioengineering	U of Calif Davis
McKee, Paul Glenn	VA	N Carolina State Univ	Electrical Engineering	Carnegie-Mellon U
McKinney, John David	VA	Evergreen State Coll	Molecular Biology	Rockefeller Univ
McLeod, Brian Andrew	OH	Cornell University	Astronomy	U Cal Santa Cruz
McNabb, John Wesley	MO	NE Missouri State Univ	Theoretical Physics	Cal Inst of Tech
McNally, Louise E.	LA	University of Delaware	Linguistics	U Cal Santa Cruz
McPeek, Mary Sara	NJ	Harvard University	Mathematics/Statistics	Stanford Univ
McQuirk, Ignacio Sean	CA	Cal Inst of Tech	Electrical Engineering	Mass Inst of Tech
Meagher, Shawn A.	IA	University of Iowa	Ecology	Univ of Michigan
Meiners, Sally Ann	MI	Michigan State Univ	Biochemistry	Michigan St Univ
Melvin, David C.	NC	Methodist College	Genetics	Duke University
Mendolia, Michael S.	NY	Mass Inst of Tech	Materials Engineering	Stanford Univ
Metz, Edward Charles	NC	Yale University	Genetics	Univ of Hawaii
Mihalisin, James E.	PA	Stanford University	Solid State Physics	Cornell Univ
Miller, Holly Jane	PA	Bloomsburg University	Biochemistry	Wake Forest Med
Miller, Rebecca Lynne	CA	Pomona College	Inorganic Chemistry	Cornell Univ
Miller, Scott A.	OH	Mass Inst of Tech	Aeronautical Engineering	Mass Inst of Tech
Mochizuki, Shinichi	NH	Princeton University	Mathematics/Algebra	Princeton Univ
Monberg, Alden Leigh	IN	University of Maine	Oceanography	Univ of Maine
Montgomery, Michael H.	TX	University of Texas	Theoretical Physics	Stanford Univ
Monti, Steven Peter	NC	Duke University	Electrical Engineering	Stanford Univ
Montoya, Mark M.	NM	New Mexico State U	Chemical Engineering	Cornell Univ
Moran, Ann Elizabeth	TX	Texas Christian Univ	Geochemistry	Rice University
Moran, Mark David	WI	University of Wisconsin	Computer Science	U Cal Berkeley
Morken, Peter A.	MN	Gustavus Adolphus Coll	Organic Chemistry	Univ of Iowa
Moroney, Richard M.	ME	Carnegie Mellon Univ	Electrical Engineering	U Cal Berkeley
Morris, Michael W.	NY	Brown University	Social Psychology	Univ of Michigan
Moses, Scott A.	OK	Oklahoma State Univ	Industrial Engineering	Oklahoma State U
Mueller, Leonard J.	NY	University of Rochester	Biochemistry	U Cal Berkeley
Mullen, Patrick A.	IN	Univ of Notre Dame	Civil Engineering	U of Notre Dame
Mumme, Donna L.	MI	University of Houston	Social Psychology	Stanford Univ
Murata, Lauren B.	AZ	Pomona College	Molecular Biology	U Cal San Fran
Musser, Jonathan W.	GA	Georgia Inst of Tech	Civil Engineering	Georgia Tech
Muzic, Raymond F.	OH	Case Western Reserve	Bioengineering	Case Western Rsv
Mytelka, Daniel S.	NJ	Princeton University	Genetics	U of Washington
Nash, Therese C.	OH	John Carroll University	Microbiology	U of Pennsylvania
Needels, Karen E.	TX	Mass Inst of Tech	Economics	Princeton Univ
Needels, Laura	TX	Rensselaer Poly Inst	Mechanical Engineering	Stanford Univ
Neiman, Aaron M.	WA	Stanford University	Molecular Biology	U Cal Berkeley
Nelson, Chad M.	CA	Cal Inst of Tech	Chemical Engineering	U Cal Berkeley
Nelson, James C.	PA	Texas A&M University	Agronomy	Cornell Univ
Nelson, Timothy A.	WA	Seattle Pacific Univ	Ecology	U of Washington
Nepf, Heidi M.	NY	Bucknell University	Civil Engineering	Stanford Univ
Neufeld, Thomas P.	MN	University of Minnesota	Cellular Biology	Harvard Med Sch
New, Michael H.	NY	Yale University	Chemistry	Columbia Univ
Newcity, Janet Ann	MD	George Washington Univ	Political Science	U Cal Berkeley
Nguyen, Cuong T.	CA	U of Calif Berkeley	Electrical Engineering	U Cal Berkeley
Nguyen, Dat Duy	VA	Mass Inst of Tech	Computer Science	Mass Inst of Tech
Nishimura, Ken A.	CA	U of Calif Berkeley	Electrical Engineering	U Cal Berkeley
Noyer, Robert R.	VA	Harvard University	Linguistics	Stanford Univ
Nutter, Brian S.	TX	Texas Tech University	Electrical Engineering	Texas Tech Univ
Nykreim, Gorm A.	WA	Univ of Washington	Physics	Cal Inst of Tech
Oakley, Martha G.	GA	Carleton College	Organic Chemistry	Cal Inst of Tech
O'Connell, Kathleen M.	VT	Mass Inst of Tech	Experimental Psychology	U Cal Berkeley
O'Curry, Suzanne L.	OR	University of Oregon	Experimental Psychology	U Cal Berkeley
Ogasawara, Gary H.	CA	U of Calif Berkeley	Computer Science	Stanford Univ
Ohlhausen, Esther L.	TX	Abilene Christian U	Inorganic Chemistry	Mass Inst of Tech
Olson, David A.	MN	St. Olaf College	Mathematics	New York Univ
Olson, Julie Beth	IL	University of Illinois	Industrial Psychology	Univ of Illinois
Omori, Sidne A.	CA	Occidental College	Cellular Biology	Stanford Univ
Opstrup, Sonja L.	VT	Rensselaer Poly Inst	Physical Chemistry	Harvard Univ
Oren, Abraham L.	HI	U of Calif Berkeley	Physics	Princeton Univ
O'Rourke, Lisa M.	NJ	Brigham Young Univ	Botany	Brigham Young U
Osborn, Thor Dane	WA	Washington State Univ	Bioengineering	U of Washington

APPENDIX A
GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Osofsky, Samuel T.	NJ	Mass Inst of Tech	Theoretical Physics	Harvard Univ
O'Steen, Shyril	WA	Univ of Washington	Zoology	Univ of Texas
Otto, Sarah P.	DC	Stanford University	Biology	Stanford Univ
Pacholczyk, Tadeusz	AZ	University of Arizona	Microbiology	Yale University
Palopoli, Michael F.	MI	University of Michigan	Ecology	Univ of Michigan
Pao, Lucy Ya	MD	Stanford University	Electrical Engineering	Stanford Univ
Park, George S.	CA	Harvey Mudd College	Optical Physics	Stanford Univ
Parker, David C.	CA	U of Calif Berkeley	Computer Science	U Cal Berkeley
Parker, Karen L.	TN	Univ of South Carolina	Genetics	Johns Hopkins Med
Parthasarathy, Hemai S.	CA	Johns Hopkins Univ	Neuroscience	Mass Inst of Tech
Patel, Aniruddh D.	DE	University of Virginia	Genetics	Harvard Univ
Pavel, Tomas J.	PA	Mass Inst of Tech	Nuclear Physics	Stanford Univ
Pearson, David A.	CA	U of Calif Berkeley	Electrical Engineering	U Cal Berkeley
Pederson, Lori M.	MI	Hope College	Inorganic Chemistry	Univ of Wisconsin
Penaz, Jane	TX	Stanford University	Psychology	U of Pennsylvania
Perrin, James D.	GA	Georgia Inst of Tech	Aeronautical Engineering	Georgia Tech
Pertel, Michael John	IL	University of Chicago	Electrical Engineering	Mass Inst of Tech
Pfannestiel, Todd J.	OK	University of Arkansas	Economics	Duke University
Pickens, Mary K.	CA	U of Cal Santa Barbara	Mechanical Engineering	U Cal Santa Barb
Pieper, John B.	IA	Univ of Northern Iowa	Solid State Physics	Univ of Iowa
Pillay, Gautam	NM	New Mexico State Univ	Chemical Engineering	U Cal Berkeley
Ping, April J.	MI	Michigan State Univ	Molecular Biology	U of Pennsylvania
Pinto, Jeannine M.	CA	Vassar College	Developmental Psychology	U of Pennsylvania
Plint, Amy C.	RI	Brock Univ (Can.)	Molecular Biology	Brown University
Poggie, Jonathan	RI	Univ of Rhode Island	Mechanical Engineering	Mass Inst of Tech
Pointer, Sam Clyde	AL	Duke University	Computer Science	Stanford Univ
Polly, Paul D.	MO	University of Texas	Zoology	Univ of Michigan
Ponder, Patricia K.	TX	Texas A&M University	Pharmacology	Duke University
Potter, Brian E.	IL	Carleton College	Atmospheric Science	U of Washington
Price, Kevin Edward	NY	SUNY at Buffalo	Mechanical Engineering	Univ of Michigan
Price, Mary Ann	AL	Univ of Montevallo	Biochemistry	Johns Hopkins U
Pringle, Mary J.	KY	University of Florida	Molecular Biology	Mass Inst of Tech
Proteau, Philip J.	WA	Univ of Washington	Organic Chemistry	Cal Inst of Tech
Rabin, Ross Steven	NY	Colorado College	Microbiology	Cornell Univ
Rablen, Paul Richard	CT	Haverford College	Organic Chemistry	Harvard Univ
Radzihovsky, Leo R.	MA	Rensselaer Poly Inst	Solid State Physics	Harvard Univ
Ragsdale, Anne B.	GA	Tulane University	Bioengineering	U of Pennsylvania
Ramakrishna, Ravi K.	VT	Cornell University	Mathematics/Algebra	Princeton Univ
Rastinejad, Fraydoon	GA	Northwestern University	Biophysics	U of Pennsylvania
Raymond, Cindy Lynn	OH	Johns Hopkins Univ	Developmental Psychology	Univ of Virginia
Raymond, Jennifer Lynn	MA	Williams College	Neuroscience	U Texas Hlth Sci
Rebay, Ilaria L.	NY	Columbia University	Biology	Yale University
Reckdahl, Keith J.	MN	Univ of Minnesota	Mechanical Engineering	Stanford Univ
Recker, Darrel A.	IA	Iowa State University	Electrical Engineering	Univ of Illinois
Reed, Michael J.	MI	Rice University	Electrical Engineering	Princeton Univ
Reeves, Melissa S.	FL	University of Florida	Physical Chemistry	Indiana Univ
Reid, Michael	NY	Harvard University	Mathematics/Algebra	U Cal Berkeley
Reider, Marc B.	PA	Case Western Reserve	Mathematics	Univ of Chicago
Reinhold, Susan M.	CA	Stanford University	Anthropology	Johns Hopkins U
Reinkensmeyer, David J.	OH	Mass Inst of Tech	Electrical Engineering	U Cal Berkeley
Reiter, Evan R.	CT	Johns Hopkins Univ	Bioengineering	Johns Hopkins U
Remick, Elizabeth J.	WA	Wellesley College	Political Science	Cornell Univ
Rhyu, Michelle S.	CA	U of Calif Berkeley	Molecular Biology	Princeton Univ
Richards, Sandra H.	LA	U of Calif San Diego	Biochemistry	U Cal San Fran
Rieke, Frederick M.	AZ	U of Calif Berkeley	Biophysics	Mass Inst of Tech
Riese, David J.	IN	Wabash College	Genetics	Yale Univ Sch Med
Roach, Elizabeth F.	VA	University of Chicago	Developmental Psychology	Univ of Chicago
Robinson, Melissa A.	KS	Rice University	Chemical Engineering	Univ of Houston
Rodriguez, Juan V.	CO	Stanford University	Electrical Engineering	Stanford Univ
Roels, Steven M.	CA	U of Calif Los Angeles	Cellular Biology	Stanford Univ
Rogers, Karen Lynn	NC	Univ of North Carolina	International Relations	Princeton Univ
Romero, L. Michael	NM	Swarthmore College	Biology	Stanford Univ
Romines, Karen R.	SC	Wake Forest University	Organic Chemistry	Harvard Univ
Ropp, Daniel N.	IL	Washington University	Mathematics/Algebra	Stanford Univ

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GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Rosario, Vernon A.	CT	Brown University	History of Science	Harvard Univ
Rose, Shoshanna D.	IN	Indiana University	Physical Chemistry	Univ of Texas
Rosen, Mark E.	ND	Univ of Minn Duluth	Physical Chemistry	U Cal Berkeley
Rosenberg, Erika L.	CA	San Jose State Univ	Experimental Psychology	U Cal San Fran
Roush, Sherrilyn M.	PA	Penn State University	History of Science	Princeton Univ
Rowehl, Karen M.	NY	Cornell University	Nutrition	Cornell Univ
Ryan, Daniel J.	PA	New Coll South Fla U	Sociology	Yale University
Rydberg, David B.	MN	St. Olaf College	Organic Chemistry	Cornell Univ
Saal, Matthew I.	NY	Princeton University	Political Science	Harvard Univ
Saecker, Mary E.	IL	Oberlin College	Physical Chemistry	Univ of Wisconsin
Sager, Brian M.	WI	University of Wisconsin	Molecular Biology	Mass Inst of Tech
Saiers, Jane A.	PA	Indiana Univ (Pa.)	Neuroscience	Princeton Univ
Salinger, Andrew G.	NY	Univ of Pennsylvania	Chemical Engineering	Stanford Univ
Sanger, Todd M.	MI	Michigan Tech Univ	Mathematics/Statistics	Iowa State Univ
Saunders, Gregory M.	OH	Ohio State University	Computer Science	Carnegie Mellon U
Saven, Jeffery G.	OH	New Coll South Fla	Physical Chemistry	Columbia Univ
Sawyer, Susan M.	FL	U of Calif Berkeley	Anthropology	U Cal Berkeley
Schaewe, Timothy J.	OH	Washington University	Electrical Engineering	Washington Univ
Schafer, Diane M.	NM	University of Texas	Mechanical Engineering	Univ of Illinois
Schilke, Brenda A.	IL	University of Illinois	Microbiology	Univ of Wisconsin
Schmidt, William J.	KS	Bethel College	Computer Science	Univ of Illinois
Schoppa, Nathan E.	TX	University of Chicago	Biophysics	U Cal Berkeley
Schroeder, Daniel P.	MN	Moorhead State Univ	Mathematics	Harvard Univ
Schulman, Leonard J.	NY	Mass Inst of Tech	Computer Science	U Cal Berkeley
Schultz, Ronald G.	MO	Univ of Missouri Rolla	Organic Chemistry	Northwestern Univ
Schwab, Stephen A.	CA	U of Calif Berkeley	Computer Science	Carnegie Mellon U
Schwandt, Leslie M.	OH	Baldwin-Wallace Coll	Experimental Psychology	Univ of Minnesota
Schwartz, Samuel W.	MI	University of Chicago	Theoretical Physics	Ohio State Univ
Seizer, Susan Amy	CA	Columbia-Barnard	Anthropology	Univ of Chicago
Shaddix, Christopher R.	CA	U of Calif Davis	Mechanical Engineering	Mass Inst of Tech
Shaffer, James S.	WV	Carnegie Mellon Univ	Chemical Engineering	Univ of Minnesota
Shamu, Caroline E.	MI	Harvard University	Molecular Biology	Mass Inst of Tech
Shannon, Christina M.	KS	University of Kansas	Economics	Harvard Univ
Shapiro, Allan D.	OH	Mass Inst of Tech	Molecular Biology	U Cal Berkeley
Shapiro, Jonathan E.	CA	U of Calif Berkeley	Mathematics	U Cal Berkeley
Sharfstein, Susan Tina	CA	Cal Inst of Tech	Chemical Engineering	U Cal Berkeley
Sherman, Bonnie R.	IN	Stanford University	Social Psychology	Princeton Univ
Shi, Bertram E.	NY	Stanford University	Electrical Engineering	Mass Inst of Tech
Shirra, Margaret K.	PA	Goucher College	Genetics	Johns Hopkins U
Shupe, David L.	CO	Mass Inst of Tech	Physics	Cornell Univ
Sidel, John T.	NH	Yale University	Political Science	U Cal Berkeley
Siegel, Stephen F.	FL	University of Chicago	Mathematics/Algebra	Oxford University
Siegwarth, Christine	NY	US Military Academy	Economics	Mass Inst of Tech
Siemann, Liese A.	NY	Cornell University	Biology	U Cal San Diego
Simes, Barbara E.	CA	U of Cal Santa Barbara	Physical Chemistry	Stanford Univ
Simmons, Jane M.	NJ	Princeton University	Electrical Engineering	Mass Inst of Tech
Singer, Steven M.	FL	Princeton University	Microbiology	Stanford Univ
Singleton, David R.	DE	University of Delaware	Pathology	Case Western Rsv
Singleton, Scott F.	TX	Trinity University	Physical Chemistry	U Cal Berkeley
Sipelstein, Jay M.	NY	Yale University	Computer Science	Carnegie Mellon U
Sitkoff, Doree F.	PA	LaSalle University	Biophysics	U of Pennsylvania
Skaja, Anne K.	MD	Johns Hopkins Univ	Chemical Engineering	Johns Hopkins U
Skrentny, John D.	IN	Indiana University	Sociology	Harvard Univ
Smerglia, Lauren S.	OH	University of Akron	Experimental Psychology	Ohio State Univ
Smith, Andrew M.	NY	Dartmouth College	Zoology	U of No Carolina
Smith, Anthony L.	GA	Georgia Inst of Tech	Mechanical Engineering	Georgia Tech
Smith, Deborah L.	MI	University of Michigan	Sociology	Northwestern Univ
Smith, Douglas B.	UT	Cornell University	Sociology	Univ of Wisconsin
Smith, Elizabeth R.	KY	Transylvania Univ	Nutrition	Columbia Univ
Smith, Ellen M.	MD	Cornell University	Ecology	U of Washington
Smith, Michael E.	IL	University of Illinois	Inorganic Chemistry	U Cal Berkeley
Smith, Susan M. E.	CA	Stanford University	Botany	Rensselaer Poly
Snodgrass, Jeffrey G.	TN	Vanderbilt University	Anthropology	U Cal Berkeley
Sodickson, Daniel K.	MA	Yale University	Biophysics	Mass Inst of Tech
Sosik, Heidi M.	MA	Mass Inst of Tech	Bio-oceanography	U Cal San Diego

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GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Spanagel, David I.	NY	Oberlin College	History of Science	U Cal Berkeley
Spencer, Brian J.	MI	Michigan Tech Univ	Metallurgy	Northwestern Univ
Spencer, Steven J.	MI	Hope College	Social Psychology	U Cal Los Angeles
Standeven, Andrew M.	PA	Ursinus College	Pharmacology	Dartmouth College
Starr, John N.	MN	Iowa State University	Chemical Engineering	U Cal Berkeley
Steidley, Theresa V.	MO	University of Missouri	Social Psychology	Princeton Univ
Steiner, Noemi Caroline	CA	Mills College	Biology	U Cal San Diego
Stenkamp, Deborah L.	ID	Whitman College	Pharmacology	Johns Hopkins Med
Stern, Joshua J.	PA	Univ of Pennsylvania	Developmental Psychology	Mass Inst of Tech
Stocker, Jonathan W.	IL	University of Illinois	Biochemistry	Stanford Univ
Stockman, Stephen A.	MO	Washington University	Electrical Engineering	Washington Univ
Stone, Randall W.	PA	Harvard University	Political Science	Harvard Univ
Story, Randall M.	CA	Rice University	Biophysics	Yale University
Strain, Steven R.	TN	Memphis State Univ	Microbiology	Oregon State Univ
Strassler, Matthew J.	MA	Princeton University	Theoretical Physics	Stanford Univ
Strauss, Tim Roger	WI	University of Wisconsin	Geography	Penn State Univ
Strickler, Jennifer A.	MA	University of Vermont	Sociology	Princeton Univ
Strobel, Kevin H.	OR	Whitman College	Mathematical Analysis	Cornell Univ
Strobel, Scott A.	MT	Brigham Young Univ	Molecular Biology	Cal Inst of Tech
Stromberg, Eric L.	WA	Univ of Washington	Mathematical Analysis	Harvard Univ
Strong, Steven P.	NY	Cornell University	Theoretical Physics	Princeton Univ
Stubenrauch, Maria L.	CO	Carleton College	Biochemistry	Univ of Colorado
Sung, Stella M.	OH	Ohio State University	Physical Chemistry	Harvard Univ
Sweeney, Lisa M.	MN	Case Western Reserve	Chemical Engineering	Cornell Univ
Swerdlow, Harold P.	NY	U of Cal Santa Cruz	Bioengineering	Univ of Utah
Szabo, Janet K.	OH	Washington College	Microbiology	US Hlth Svc Univ
Szewczak, Alexander A.	PA	Lehigh University	Biochemistry	Yale University
Tabachneck, Hermina J.	MI	Wayne State University	Experimental Psychology	U of Pennsylvania
Talghader, Joseph J.	TX	Rice University	Electrical Engineering	Stanford Univ
Tapp, Paul R.	TX	Mass Inst of Tech	Molecular Biology	Harvard Med Sch
Taylor, Washington	MA	Stanford University	Theoretical Physics	U Cal Berkeley
Thau, Robert S.	NJ	Harvard University	Neuroscience	Mass Inst of Tech
Theriot, Julie Anne	IL	Mass Inst of Tech	Molecular Biology	U Cal San Fran
Thompson, Kathleen A.	SD	U of Calif San Diego	Pathology	U Cal San Diego
Tikofsky, Andrew M.	WI	Cal Inst of Tech	Theoretical Physics	U Cal Berkeley
Tolman, Susan	DE	University of Chicago	Mathematical Analysis	Harvard Univ
Townsend, Sarah E.	NY	Cornell University	Microbiology	U Cal Berkeley
Tu, Jay K.	TX	Rice University	Electrical Engineering	U Cal Berkeley
Tucker, Jennifer G.	AL	Stanford University	History of Science	Harvard Univ
Turton, Deborah A.	PA	Cornell University	Anthropology	Univ of Chicago
Ulm, Eric T.	OH	Ohio State University	Solid State Physics	Ohio State Univ
Umen, James G.	MN	Stanford University	Biochemistry	U Cal San Fran
Umminger, Christopher	MO	Cal Inst of Tech	Electrical Engineering	Stanford Univ
Underwood, Judith L.	WA	Oberlin College	Computer Science	Mass Inst of Tech
Unger, Alison L.	OH	Carleton College	Cellular Biology	Washington Univ
van Dijk, Luke H.	CA	U of Calif Berkeley	Theoretical Physics	Univ of Chicago
Van Stone, Kathryn L.	CA	Harvey Mudd College	Computer Science	Stanford Univ
Van Vranken, David L.	TX	University of Texas	Organic Chemistry	Stanford Univ
Vesely, Edward J.	IL	University of Illinois	Electrical Engineering	Univ of Illinois
Vesey, Roger A.	OH	Rensselaer Poly Inst	Nuclear Engineering	Mass Inst of Tech
Vingerhoet, Lisa A.	MA	Mass Inst of Tech	Chemical Engineering	Mass Inst of Tech
Vlasak, Dean A.	IL	University of Illinois	Electrical Engineering	Univ of Illinois
Vookles, Jennifer F.	TN	Dartmouth College	Social Psychology	New York Univ
Walker, Karen E.	NM	Swarthmore College	Sociology	U of Pennsylvania
Wall, Mary E.	PA	Mass Inst of Tech	Chemical Engineering	Mass Inst of Tech
Walter, Richard L.	OH	College of Wooster	Veterinary Science	Ohio State Univ
Wang, Alexander	IL	Mass Inst of Tech	Computer Science	Stanford Univ
Wang, Andrew J.	CA	U of Calif Berkeley	Economics	Harvard Univ
Wang, Avery L.	CA	Stanford University	Electrical Engineering	Mass Inst of Tech
Wang, Katherine S.	CA	U of Calif Berkeley	Electrical Engineering	Mass Inst of Tech
Wang, Mark Yu Da	OK	Mass Inst of Tech	Nuclear Physics	Mass Inst of Tech
Wang, Paul P.	IN	Mass Inst of Tech	Computer Science	Mass Inst of Tech
Ward, Andrew J.	VA	Yale University	Mathematics/Algebra	Harvard Univ
Warnke, Kevin C.	NH	US Naval Academy	Bioengineering	Univ of Virginia
Watry, Derek L.	CA	U of Calif San Diego	Mechanical Engineering	U Cal Berkeley

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GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	CHOSEN INSTITUTION
Watt, David M.	CA	U of Calif Berkeley	Physical Chemistry	Univ of Chicago
Weaver, Leslie L.	VA	North Carolina State U	Aeronautical Engineering	No Carolina State
Weinstein, Anders	NY	Harvard University	History of Science	U of Pittsburgh
Weinstein, Randi Beth	NY	SUNY at Buffalo	Physiology	U Cal Berkeley
Weir, William N.	TX	Harvard University	Astronomy	Harvard Univ
Weissman, Jonathan S.	CT	Harvard University	Solid State Physics	CornellUniv
Weisz, Carolyn	CA	Stanford University	Social Psychology	Princeton Univ
Weliky, David P.	NJ	Swarthmore College	Physical Chemistry	Univ of Chicago
Weller, Timothy N.	MI	Michigan State Univ	Electrical Engineering	Univ of Illinois
Wheeler, Erlan E.	OH	VA Poly Tech & State U	Mathematics/Algebra	Mass Inst of Tech
Whitehurst, Todd K.	TN	Vanderbilt University	Electronic Engineering	U Cal Berkeley
Wick, Peter F.	NY	Northeastern University	Pharmacology	U Mich Med Sch
Wicklin, Frederick J.	FL	Guilford College	Mathematics	Brown University
Wiesenfelder, Heidi S.	IL	U of Southern Calif	Experimental Psychology	Vanderbilt Univ
Wilhelm, Sheryl R.	TX	Princeton University	Environmental Science	Univ of Waterloo
Wilkerson, Marlon S.	IL	Murray State Univ	Geology	Univ of Illinois
Wilson, Margaret L.	CA	Reed College	Developmental Psychology	U of Pennsylvania
Wilson, Paul S.	CA	Humboldt State Univ	Ecology	U Cal Riverside
Winberg, Margaret L.	CA	U of Calif Berkeley	Microbiology	Stanford Univ
Winter, Alison	MI	University of Chicago	History of Science	Univ of Cambridge
Wirt, Heidi J.	CA	University of Wisconsin	Biochemistry	Univ of Wisconsin
Wiser, Susan K.	MD	Cornell University	Ecology	U of No Carolina
Wissinger, John W.	TX	Rice University	Electrical Engineering	Stanford Univ
Wojtowicz, Ralph L.	TN	Rensselaer Poly Inst	Aeronautical Engineering	Mass Inst of Tech
Wolff, Gregory J.	MO	Mass Inst of Tech	Developmental Psychology	Carnegie Mellon U
Wolfsberg, Tyra G.	CA	Princeton University	Molecular Biology	U Cal San Fran
Woodward, Amanda L.	NY	Swarthmore College	Developmental Psychology	Stanford Univ
Worth, John E.	GA	University of Georgia	Archeology	Univ of Florida
Wuttke, Deborah S.	NY	University of Rochester	Biochemistry	Univ of Oxford
Wyner, Abraham J.	NJ	Yale University	Mathematics/Statistics	Stanford Univ
Yang, Julia S.	OK	Mass Inst of Tech	Mathematics	Mass Inst of Tech
Yoo, Michael J.	IL	Harvard University	Solid State Physics	Mass Inst of Tech
York, Jeremy C.	IL	University of Illinois	Mathematics/Statistics	U of Washington
Young, Nelson D.	OR	University of Oregon	Botany	Cornell Univ
Yu, Jenny S.	IL	U of Calif Berkeley	Bioengineering	Harvard Univ
Zimmerman, Christopher	IN	Princeton University	Computer Science	Stanford Univ
Zimmerman, Martin L.	IL	Cal Inst of Tech	Electrical Engineering	Univ of Illinois
Zimmerman, William B.	PA	Princeton University	Chemical Engineering	Stanford Univ
Zsiga, Elizabeth C.	CT	Wesleyan University	Linguistics	Yale University
Zuiker, Christopher D.	WI	University of Illinois	Nuclear Engineering	Mass Inst of Tech

APPENDIX B
MINORITY GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY87

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	FELLOWSHIP INSTITUTION
Aquino, Karl F	IL	University of Illinois	Industrial Psychology	Univ of Maryland
Armas, Liliana	FL	Harvard University	Political Science	Stanford University
Ashford, Marvin Winston	LA	Tulane University	Bioengineering	Vanderbilt Univ
Bergnes, Gustave	FL	Florida International	Organic Chemistry	University of Texas
Brooks, Charles Anthony	NY	Rensselaer Polytechnic	Electrical Engineering	U Cal Berkeley
Cangahuala, Laureano	PA	Mass Inst Technology	Aeronautical Engineering	Mass Inst Tech
Capozzoli, Anthony Beach	NJ	Princeton University	Mathematics/Logic	U Cal Berkeley
Chadwick, Kirk Michael	ID	University of Utah	Chemical Engineering	Univ of Utah
Cobb, Stephen Bradley	CA	Harvey Mudd Coll/CA	Electrical Engineering	Stanford University
Cramer, Audrey Ellen	OR	Central Wash Univ	Biology	UCLA
Cruz, Jacqueline	CA	Univ of Cal Los Angeles	Chemical Engineering	UCLA
Davila-Aponte, Jennifer	FL	Duke University	Molecular Biology	Univ of Colorado
Davis, Ricardo Corye	AR	U of Ark Little Rock	Physical Chemistry	Texas A&M Univ
Duster, Jon Sweat	IL	Stanford University	Electrical Engineering	U Cal Berkeley
Eggleton, Charles D	CA	Univ of Calif Berkeley	Aeronautical Engineering	Stanford University
Ellison, Viola	MI	Wayne State Univ/MI	Molecular Biology	Harvard University
Escobar, Walter A	CA	Univ of Calif Davis	Molecular Biology	U Cal San Diego
Fernandez, Daniel Martin	NY	Purdue University	Electrical Engineering	Cal Inst Tech
Fields, Cecelia Ann	GA	Howard University/DC	Experimental Psychology	Univ of Virginia
Gomez, Laura E	NM	Harvard University	Sociology	Stanford University
Hanna, David Manuel	TX	Cornell University	International Relations	Stanford University
Henderson, Errol Anthony	MI	Wayne State Univ/MI	Political Science	Univ of Michigan
Hernandez, Evelio	PR	Georgia Inst Tech	Chemical Engineering	Mass Inst Tech
Hussey, Deborah Martha	CA	Vassar College/NY	Neuroscience	U Cal San Francisco
Keys, Phyllis Yolanda	MS	Univ of Mississippi	Mechanical Engineering	Stanford University
Lopez, Gretchen Eva	NY	Cornell University	Social Psychology	Univ of Michigan
Martinez, Marino Juan	VA	Univ of Notre Dame	Electrical Engineering	Univ of Colorado
Martins, Emilia Pereira	CO	Univ of Calif Berkeley	Zoology	Univ of Tennessee
McGuire, Hugh Wingfield	CA	Harvard University	Computer Science	Mass Inst Tech
McKamey, Stuart Henry	CA	Univ of Calif Berkeley	Entomology	No Carolina St Univ
Miles, Floyd Mike	CO	US Military Academy	International Relations	Columbia University
Mitchell, Samuel Foyd	CO	Auburn University	Political Science	Harvard University
Montes, Errol	PR	Univ of Puerto Rico	Mathematics/Analysis	Univ of Puerto Rico
Montes, Marcos Jordan	NM	New Mexico State U	Particle Physics	Cal Inst Tech
Mulero, Julio Jose	PR	Clark University/MA	Biochemistry	Yale University
Ortiz, Ana Teresa	PR	Univ of Mass Boston	Anthropology	Harvard University
Quesada, Peter Mitchel	TX	University of Texas	Bioengineering	U Cal Berkeley
Rabindran, Ray	TX	Texas A&M University	Biochemistry	Mass Inst Tech
Ramirez-Kindred, Jaime	IA	University of Iowa	Electrical Engineering	Cal Inst Tech
Ritchie, Mark Andrew	NY	Wheaton College/IL	Sociology	U Cal Berkeley
Rodriguez, Daniel	VA	US Military Academy	Economics	Mass Inst Tech
Romo, Daniel	TX	Texas A&M University	Organic Chemistry	Colorado State Univ
St Mary, Colette Marie	MA	Harvard University	Bio-oceanography	U Cal Santa Barbara
Socorro, Adolfo J	PR	Univ of Mass Amherst	Computer Science	U of Mass Amherst
Suleiman, Layla P	IL	Loyola Univ Chicago	Personal Psychology	Stanford University
Tolson, Marc D	MD	Florida A&M University	Economics	U of Pennsylvania
Vanhooke, Janeen LaVay	NC	Univ of North Carolina	Biochemistry	Brandeis University
Vera, James Santiago	TX	Rice University	Electrical Engineering	Stanford University
Vilches, Ramon Antonio	CO	Univ of Colorado Denver	Economics	Mass Inst Tech
Viray, Joseph V	IN	Rose-Hulman Tech/IN	Mechanical Engineering	Stevens Inst Tech
Wiese, Gina Maria	MN	Carleton College/MN	Social Psychology	Univ of Michigan
Wiggins, Kerri Lynn	WA	Seattle Pacific Univ	Mathematics/Applications	Univ of Washington
Williamson, Laura	IL	University of Illinois	Developmental Psychology	Stanford University
Wills, Darryl Sidney	DC	Howard University/DC	Economics	U Cal Berkeley
Wyman, Lyndsey Pilar	DE	St Johns College/MD	Mathematics/Applications	U Cal Berkeley

APPENDIX B
MINORITY GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	FELLOWSHIP INSTITUTION
Abraham, Amy J.	CA	Stanford University	Social Science	Harvard University
Abeledo, Hernan G.	NJ	Univ of Buenos Aires	Mathematics	Rutgers University
Acuna, Eduardo L.	IL	University of Illinois	Electrical Engineering	Univ of Illinois
Ackermann, Ruby	NY	Univ of Pennsylvania	Developmental Psychology	U of Pennsylvania
Adams, Jayson L.	CA	Stanford University	Electrical Engineering	Stanford University
Anderson, James A.	NY	Mass Inst of Technology	Engineering	Mass Inst of Tech
Arrieta, Richard M.	IN	Cal Inst of Technology	Mechanical Engineering	U of Calif Berkeley
Arroyo, Juan	RQ	Univ of Puerto Rico	Microbiology	Univ of Michigan
Askew, Kelly M.	CA	Yale University	Anthropology	Harvard University
Barbosa, Peter	RQ	Texas A&M University	Biochemistry	Baylor Coll of Med
Berg, Christine A.	NC	North Carolina State U	Inorganic Chemistry	Northwestern Univ
Calderas, Jon J.	OH	Ohio State University	Bioengineering	Northwestern Univ
Caesar, Camille M.	DC	Harvard University	International Relations	Harvard University
Chin-Quee, Dawn S.	FL	Boston University	Developmental Psychology	Univ of Virginia
Colon, Grace E.	RQ	Univ of Pennsylvania	Microbiology	Univ of Minnesota
Cowan, Collette D.	IL	Northwestern Univ	Electrical Engineering	Stanford University
Cruz, Maribel H.	NY	Allegheny College	Social Psychology	Univ of Michigan
Dedeaux, Debra A.	MS	Tougaloo College	Organic Chemistry	University of Texas
Delemos, Kimberly A.	VI	Wittenberg Univ	Experimental Psychology	Syracuse University
Derda, Gregory S.	FL	Univ of West Florida	Botany	Univ of Georgia
de Veciana, Gustavo A.	CA	U of Calif Berkeley	Electrical Engineering	U of Calif Berkeley
Diaz, Anna M.	TX	University of Texas	Social Psychology	Stanford University
Egbuonu, Monica E.	NY	Princeton University	Physiology	Penn State Univ
Estabrook, Elizabeth M.	NM	New Mexico State U	Molecular Biology	New Mexico State U
Esmahan, A. Christina	OH	Miami University	Microbiology	Univ of Leon/Spain
Faguet, Jean-Paul G.	GA	Princeton University	Political Science	Catholic Univ Chile
Foster, Samuel E.	WI	Andrews University	Organic Chemistry	Univ of Cal Irvine
Fox Tree, Jean E.	MA	Harvard University	Developmental Psychology	Stanford University
Flores, Idhaliz	RQ	Univ of PR Mayaguez	Microbiology	Rutgers University
Francis, Cynthia E.	VI	Coll of Virgin Islands	Microbiology	Boston University
Francisco, Wilson A.	RQ	Univ of PR Mayaguez	Organic Chemistry	Texas A&M Univ
Gamec, Kimberley E.	CO	Colorado State Univ	Geophysics	Univ of Washington
Goldman, Susan L.	TX	Univ of Texas Dallas	Experimental Psychology	North Texas St Univ
Gordon, Clarence L.	VA	University of Illinois	Optical Physics	Stanford University
Gonzalez, Tania N.	OH	Kenyon College	Molecular Biology	U of Calif Berkeley
Guillory, Stanford S.	TX	Washington University	Electrical Engineering	Univ of Illinois
Harris, Cheryl L.	VA	Univ of Tennessee	Mechanical Engineering	Mass Inst of Tech
James-Hernandez, F. L.	CO	Stanford University	Anthropology	Stanford University
Jeffredo-Warden, Louise	CA	U. Southern California	Anthropology	Stanford University
Jones, Michael A.	FL	Rice University	Political Science	Princeton Univ
Kaim, David	TX	University of Texas	Molecular Biology	Univ of Wisconsin
Krehbiel, David K.	KS	McPherson College	Analytical Chemistry	Univ of Kansas
Lara, Rosemarie S.	IA	University of Iowa	Bioengineering	Mass Inst of Tech
Laureano, Raymond	FL	Polytech Univ of P.R.	Electronic Engineering	U Central Florida
Lengyel, Jerome E.	NH	Cal Inst of Tech	Computer Science	Cornell University
Lewis, Carole E.	NY	Amherst College	Experimental Psychology	CUNY Grad School
Lincoln, Patrick D.	MN	Mass Inst of Tech	Computer Science	University of Texas
Lucas, Samuel R.	DC	Haverford College	Sociology	Univ of Wisconsin
Lugo, Hector Manuel	RQ	Haverford College	Sociology	Univ of Chicago
Marcus, Sherry E.	NY	Cornell University	Math/Logistics	Harvard University
Martinez, Sergio E.	NY	Cornell University	Biochemistry	Purdue University
McClaurin-Allen, Irma	IL	Grinnell College	Anthropology	U of Massachusetts
Mendelberg, Tali	WI	Univ of Wisconsin	Political Science	Univ of Michigan
Medina, Maximino	RQ	Univ of PR Mayaguez	Chemical Engineering	U of South Florida
Morgan, Michael C.	MD	Mass Inst of Tech	Meteorology	Mass Inst of Tech
Nembhard, Jessica G.	NY	Yale University	Economics	U of Massachusetts
Orive, Maria E.	WA	Stanford University	Genetics	U of Calif Berkeley
Papavaritis, Peter	FL	University of Miami	Fluid Physics	Mass Inst of Tech
Pattillo, Catherine A.	WI	Harvard University	Economics	Mass Inst of Tech
Perez, Lorelei E.	CA	U of Calif San Diego	Physiology	Boston University
Posey, Melanie A.	MD	Amherst College	International Relations	Sch Adv Intl Std
Qualls, Russell J.	WA	Seattle Pacific Univ	Civil Engineering	U of Calif Berkeley
Salaam, Amin A.	NY	Queens College	Computer Science	New York University
Sassi, Alexander P	WA	Univ of Washington	Chemical Engineering	U of Calif Berkeley
Snook, David R.	CA	U of Calif Berkeley	Biology	Univ of Colorado

APPENDIX B
MINORITY GRADUATE FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	FELLOWSHIP INSTITUTION
Socci, Nicholas D.	NY	Harvard University	Biophysics	U of Calif Berkeley
Soto, Maria M.	RQ	Haverford College	Chemistry	Cornell University
Thompson, Marilyn E.	AL	Univ of South Alabama	Pharmacology	Univ South Alabama
Traquair, Philip S.	CA	Pomona College	Sociology	Northwestern Univ
Ward, Margaret L.	RQ	Univ of PR Mayaguez	Electronic Engineering	Rensselaer Poly
Wheelock, Carmen D.	LA	Louisiana State Univ	Biochemistry	La State University
Williams, Mark E.	MI	University of Michigan	Political Science	Univ of Michigan
Williams, Mark W.	CA	U of Cal Santa Barbara	Zoology	U Cal Santa Barbara
Wynn, Aaron S.	VA	University of Virginia	Electrical Engineering	Mass Inst of Tech
Zemella, Ricardo J.	NM	Mass Inst of Tech	Aeronautical Engineering	Mass Inst of Tech

APPENDIX C
NATO POSTDOCTORAL FELLOWSHIP AWARDS
NEW AWARDS - FY87

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	NATO INSTITUTION
William W. Adams	MO	Australian National U	Botany	U of Wurzbuth West Germany
Douglas J. Arent	CO	Princeton University	Materials Science	Interuniv Micro. Ctr., Belgium
Leon Avery	MA	Mass Inst of Tech	Neurosciences	MRC-Mol Bio Lab Cambridge, England
Scott W. Bartyon	PA	Univ of Chicago	Physical Chemistry	College de France Paris, France
Bruce J. Bayly	NY	Courant Institute	Applied Mathematics	Cambridge University England
Helga R. Berk	FL	Max-Planck Institute	Bioengineering	Max-Planck Institute West Germany
Michael J. Bogusky	PA	Univ of Pennsylvania	Biophysics	Oxford University England
Catherine A. Briasco	MA	Stanford University	Bioengineering	Lab de Tech Enzyme France
Michael R. Briggs	DE	U of Cal - Berkeley	Biochemistry	U of Zurich Switzerland
Douglas W. Burbank	CA	U of Southern CA	Geology	Cambridge University England
John C. Card	NJ	Univ of Wisconsin	Chemical Engrg	Ecol Natl Supr Nancy, France
Edward W. Castner	DC	Univ of Chicago	Physical Chemistry	Univ of Croningen The Netherlands
Ruth A. Daly	MA	Boston University	Astronomy	Cambridge University England
Michael P. Diebold	IL	Texas A&M University	Inorganic Chemistry	Cambridge University England
Betty A. Dobratz	IO	Iowa State University	Sociology	Panteios Poly Sci Greece
Gregory L. Eyink	OH	Ohio State University	Theoretical Physics	Free U of Brussels Belgium
Benny D. Freeman	CA	U of Cal - Berkeley	Chemical Engrg	Ecole de Phys Paris, France
John P. Giese	KS	Kansas State Univ	Atomic and Molecular Physics	Univ of Aarus Denmark
Deborah M. Gordon	MA	Harvard University	Math Modelling of Biol Systems	Oxford University England
David W. Grahm	MA	Woods Hole Ocean Inst	Geochemistry	Univ of Paris France
Douglas E. Grotjahn	CA	U of Calif - Berkeley	Organic Chemistry	Philipps University West Germany

APPENDIX C
NATO POSTDOCTORAL FELLOWSHIP AWARDS
NEW AWARDS - FY87

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	NATO INSTITUTION
Jon M. Harrison	CO	Univ of Colorado	Physiology	U British Columbia Canada
Lawrence A. Hirschfeld	WI	Univ of Wisconsin	Dev Psychology	Eco Pract de Hautes Etudes, France
Alice H. Huang	PA	Univ of Washington	Physiology	U of Freiburg West Germany
Sara C. Huckett	IO	Iowa State University	Inorganic Chemistry	Max-Panck Inst West Germany
Donna C. Hurley	IN	Univ of Illinois	Solid State Physics	U of Nottingham England
Deab M. Jacobson	CA	Woods Hole Ocean Inst	Biological Ocean	Univ of Oslo Norway
Jens Jensen	CA	Princeton University	Solid State Physics	NORDITA Denmark
Amy S. Johnson	CA	U of Calif - Berkeley	Zoology	U British Columbia Canada
Mark S. Johnson	CA	U of CA - San Diego	Molecular Biology	Univ of London England
David N. Karowe	MI	Univ of Michigan	Ecology	Univ of Leiden The Netherlands
Warren L. Kovach	IN	Indiana University	Botany	Univ of Aberdeen Scotland
Timothy J. Lee	CO	U of Calif - Berkeley	Theoretical Chem	Cambridge Univ England
Mark F. Mathias	PA	Univ of Wisconsin	Chemical Engrg	U of de Rennes France
Steven W. McCauley	CA	California State Poly	Biophysics	Max-Planck Inst West Germany
William D. McGhee	CA	U of Calif - Berkeley	Organometallic Chemistry	Oxford Univ England
Paul F. Mendler	NY	Cornell University	Computer Science	Manchester Univ England
Joseph S. Meyer	WY	Univ of Wyoming	Limnology	Swiss Fed Inst Water Res. Switzerland
Juan C. Migliore	NJ	Drew University	Mathematics	U.D. Studi di Trento Italy
Steven L. Neuberg	PA	Carnegie Mellon Univ	Social Psychology	Univ of Waterloo Canada
Ronald K. Perline	PA	Drexel University	Geometry	Eidgen T Hochschule Switzerland
Christopher Petersen	PA	Univ of Washington	Behavioral Ecology	Simon Fraser Univ Cananda

APPENDIX C
NATO POSTDOCTORAL FELLOWSHIP AWARDS
NEW AWARDS - FY87

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	NATO INSTITUTION
Brian K. Peterson	IN	Cornell University	Physical Chemistry	Oxford University England
John W. Pomeroy	OH	U of Saschatchewan	Enviorn Science	Univ of East Anglia England
Laurie C. Reisberg	NJ	Lamont-Doherty Observ	Geochemistry	Inst de Phys de Glob Paris, France
Keith M. Reynolds	OH	Ohio State University	Phytopathology	Rothamsted Exptl Sta England
Michael E. Smith	CA	U of Cal - Los Angeles	Experimental Physiology	INSERM Paris, France
Robert W. Sterner	PA	Max-Planck Inst	Ecology	Max-Planck Inst West Germany
Ann L. Stoler	WI	Univ of Wisconsin	Anthropology	Univ of Amsterdam The Netherlands
Howard A. Stone	CA	Calif Inst of Tech	Chemical Engrg	Cambridge Univ England
Stephen A. Swift	NH	Woods Hole Ocean Inst	Geology	Univ of Kiel West Germany
Diane M. Tasset	CO	Univ of Colorado	Genetics	INSERM Strassbourg, France
Wade O. Troxell	CO	Colorado State Univ	Computer Engrg	Univ of Edinburgh Scotland
John M. Vohs	DE	Univ of Delaware	Chemical Engrg	Univ of Notre Dame Belgium
Peter J. Vrolijk	CA	U of Cal - Santa Cruz	Geology	Cambridge University England
Clyde Wilson	CA	U of Cal - Davis	Botany	U of de Poiters France
Lewis E. Wedgewood	IL	Univ of Wisconsin	Biophysics	Univ of Freiburg West Germany
Anthony J. Zera	TX	Univ of Texas	Physiology	Univ of Toronto Canada

APPENDIX C
NATO POSTDOCTORAL FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	NATO INSTITUTION
Alexander S. Aiken	OH	Ohio State Univ	Computer Science	Oxford University United Kingdom
Mark R. Bassett	VA	Univ of Virginia	Chemical Engrg	Fritz-Haber Institut Berlin, West Germany
Henry N. Berry	MA	U of Massachusetts	Geology	Univ of Oslo Norway
Kirk E. Brattkus	ID	Northwestern Univ	Applied Math	Ecole Normale Superieure, Paris, France
Nathan J. Bryson	AL	Mass Inst of Tech	Organometallic Chemistry	U. of Louis Pastuer France
Marcus I. Bursik	CA	Cal Inst of Tech	Geology	Cambridge Univ England
Mark E. Bussell	CA	U Calif - Berkeley	Chemistry	Ecole Nat'l Super de Chime, Paris, France
Brian F. Byrd	WI	American Ctr Oriental Research, Jordan	Archaeology	Forhistorisk Museum Hojbjerg, Denmark
Bernard J. Crespi	MI	Univ of Michigan	Ecology	Oxford University United Kingdom
Elissa Derrickson	MD	Smithsonian	Ecology	U of Western Ontario Canada
William H. Green, Jr.	CA	U Calif - Berkeley	Theoretical Chemistry	Cambridge University England
David R. Grant	MI	Univ of Michigan	Number Theory	Cambridge University England
Jonathan G. Harris	IL	Univ of Chicago	Physical Chemistry	Cambridge University England
Carolyn F. Hickey	AZ	Univ of Arizona	Optics	Univ of St. Jerome France
Brian R. Hill	MA	Harvard University	Theoretical Physics	Simon Fraser Univ Canada
Mary S. Hubbard	CO	Mass Inst of Tech	Geology	U of Leicester England
William A. Jeffrey	IL	Harvard University	Astronomy	Cambridge University England
Kazuko D. Jofuku	CA	U Calif - Berkeley	Plant Molecular Biology	Rijksuniversiteit Ghent, Belgium
James T. Kellis	CA	U of Calif - Irvine	Biochemistry	Imperial College of Sci & Tech, England
Robert G. Kelly	MD	Johns Hopkins Univ	Materials Engineering	Univ of Manchester England
Julia A. Kornfield	CA	Stanford University	Chemical Engineering	Max Planck Institute Maize, West Germany

APPENDIX C
NATO POSTDOCTORAL FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	NATO INSTITUTION
Richard C. Leavitt	MD	Johns Hopkins Univ	Atomic & Molecular Physics	Univ of Amsterdam The Netherlands
James R. Lovvorn	GA	Univ of Wisconsin	Ecology	U British Columbia Canada
Richard B. Lowell	WA	Dalhousie Univ Canada	Ecology	Univ of Liverpool England
Paul R. Lundgren	MN	Northwestern Univ	Geophysics	Nat'l Inst of Geophysics Rome, Italy
Gregory McDermott	CA	U Calif - Berkeley	Inorganic Chemistry	Imperial College London, England
Catherine McFadden	WA	U of Washington	Biology	Univ of Liverpool England
Raman L. Mitra	PA	U of Pennsylvania	Biophysics	Inst. of Louis Pastuer Strasborg, France
Andrea K. Myers	NJ	Princeton Univ	Semiconductor	Cambridge University England
Joseph R. Pawlik	MN	Scripps Inst of Oceanography	Biological Oceanography	Marine Science Labs Menai Bridge, Wales
Sharon L. Pedersen	PA	U of Pennsylvania	Mathematical Sci	Inst des Hautes Etudes Sci. Pures-sur-Yvette France
Kathleen B. Pigg	OH	Ohio State Univ	Paleobotany	University of Alberta Canada
William O. Putikka	MN	Univ of Wisconsin	Solid State Physics	Eidg Tech Hochschule Zurich Switzerland
Daniel P. Raleigh	CA	Mass Inst of Tech	Biophysics	Oxford University United Kingdom
Joseph W. Roos	LA	Louisiana State Univ	Biochemical Engineering	Biotechnology Inst Lyngby, Denmark
Igor Reider	OK	Univ of Oklahoma	Algebraic Geometry	Univ of Paris France
Charles H. Robert	CO	Univ of Colorado	Biophysical Chem	Univ of Basel Switzerland
Eugene W. Schupp	FL	University of Iowa	Ecology	Estacion Biologica Seville, Spain
Howard S. Sellers	MD	Johns Hopkins Univ	Engineering Science	Technical U Berlin West Germany
Vivan Siegel	CA	U Ca - San Francisco	Cellular Biology	Max Plank Institute West Germany
Curtis L. Shellum	CO	Univ of Colorado	Analytical Chemistry	University of Graz Austria
Alice M. Smith	OH	Harvard University	Physical Chemistry	Univ of Munich West Germany

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NATO POSTDOCTORAL FELLOWSHIP AWARDS
NEW AWARDS - FY88

NAME	HOME STATE	BACCALAUREATE INSTITUTION	FIELD	NATO INSTITUTION
Donald A. Spector	NY	Cornell University	Elementary Particle Physics	Inst for Theoretical Physics, Utrecht, The Netherlands
Jeffrey E. Steif	NJ	Stanford University	Erodic Theory	Stockholm University Sweden
Philip S. Stewart	CO	Stanford University	Microbiology	Univ of Edinburgh Scotland
Wesley I. Sundquist	MA	Mass Inst of Tech	Biochemistry	Lab Molecular Biology Cambridge, England
Ethan J. Temeles	TN	Univ of Tennessee	Ecology	Univ British Columbia Canada
Robert J. Thieke	NY	U Calif - Berkeley	Civil Engineering	Cambridge University England
Tamalie Vanderrlick	MN	Univ of Minnesota	Chemical Engineering	Univ of Mainz West Germany
Norman J. Wagner	NJ	Princeton University	Chemical Engineering	Univ of Constance West Germany
Paul J. Watson	NM	Cornell University	Zoology and Microbiology	Oxford University England
James D. Webster	VA	Univ of Virginia	Experimental Psychology	Univer of Edinburgh Scotland
Michael Webster	CA	U Calif - Berkeley	Experimental Psychology	Cambridge Universtiy England
Jennifer Widom	CA	Cornell University	Computer Science	Oxford Univerrsity England
Jerrel L. Yakel	CA	U Calif - Los Angeles	Neuroscience	Ecole Normale Super Paris, France
Brenda L. Young	FL	U of South Carolina	Ecology	Inst Marine Environ. Res., England
Arthur Z. Zelent	NM	City Univ New York	Molecular Biology	Inst Biological Chem Strasbourg, France

Program Solicitations:

Targeted solicitations of project proposals are issued from time to time by Offices and Divisions of the Directorate. Copies of current solicitations may be requested from the NSF Forms and Publications Unit, whose address is shown at the bottom of this page. Examples of recent solicitations include:

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Private Sector Partnerships to Improve Science and Mathematics Education	(NSF 88-71)
Projects to Promote the Effective Use of Technology in the Teaching of Science and Mathematics	(NSF 88-103)

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Directory of Awards: FY86	(NSF 87-20)
Directory of NSF-Supported Teacher Enhancement Projects - Summer 1987	(NSF 87-21)
Presidential Young Investigators 1987 Awards	(NSF 87-54)
College Science Instrumentation 1986 Awards	(NSF 86-65)
Summary of Grants, FY 1984-86; Research in Teaching and Learning	(NSF 86-84)
Summary of Grants, FY 1984-86; Instructional Materials Development	(NSF 86-85)
Summary of Grants, FY 1984-86; Informal Science Education	(NSF 86-86)
Summary of Grants, FY 1984-86; Applications of Advanced Technology	(NSF 86-87)
Summary of Active Awards; Studies and Analyses Program	(NSF 88-97)

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Grants for Research and Education in Science and Engineering	(NSF 83-57, rev 11/87)

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Room 232
National Science Foundation
Washington, DC 20550